

The University of Chicago

DRY-FARMING ADJUSTMENTS
IN UTAH

A PART OF A DISSERTATION SUBMITTED
TO THE FACULTY OF THE DIVISION OF THE
PHYSICAL SCIENCES IN CANDIDACY FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF GEOGRAPHY

1937

By
NORAH E. ZINK

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June, 1937

Norah E. Zink
Indiana, Pennsylvania

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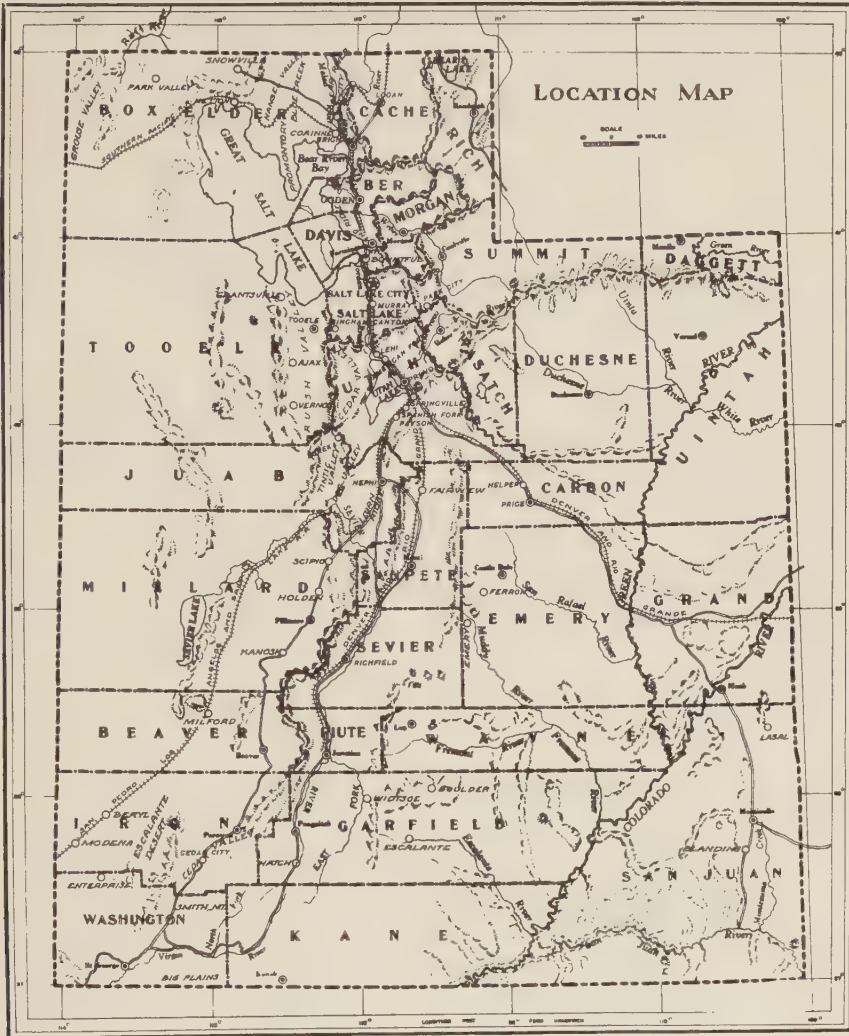


Figure 1

Relief Map of Utah, Courtesy of United States Census Bureau

PART I

THE SIGNIFICANCE OF THE INDUSTRY

"The West [Utah], in the end as in the beginning, a dry land--so that all problems returned to the master problem of how to get enough water on land for which there could never be water enough."--Bernard De Voto.

Dry-farming on a scientific basis has been important in Utah since 1903. Shortly before that time a need for additional farm lands in the state became apparent. It would have been possible to meet this need temporarily, or in part, by a more efficient use of the water then available for irrigation and a development of additional storage facilities. The demand for more land was satisfied, however, on a large scale and by a novel procedure.¹ Through the use of practices which conserved moisture, lands which lacked irrigation water were tilled.² By this means three or four hundred thousand acres of land previously considered incapable of being farmed were brought under cultivation.

Definition of the term "dry-farming."--In his book Dry-Farming, Dr. John A. Widtsoe, a former Director of the Utah Agricultural Experiment Station at Logan and one of the foremost leaders in establishing this new type of farming in the state, defines the term, according to its use in the United States, as referring to the profitable production of useful crops without irrigation on lands which receive less than 20 inches of rain; or, as ordinary agricultural practice, so modified as to make use of every opportunity to conserve moisture.³ William Macdonald defined

¹Isaiah Bowman, The Pioneer Fringe, American Geographical Society, Special Publication No. 13 (New York, 1931), p. 8.

²F. H. Newell, "Progress in Reclamation of Arid Lands in the Western United States," Annual Report of the Board of Regents of the Smithsonian Institution for the Year Ending June 30, 1911 (Washington: Government Printing Office, 1912), p. 181.

³See John Andreas Widtsoe, Dry-Farming (New York: Macmillan Co., 1911).

the term as follows: "The conservation of moisture during long periods of dry weather by means of tillage, together with the growth of drought-resistant plants."¹ In Utah both the application of the principles of scientific dry-farming and the use of strains of wheat and other crops adapted to the semi-arid climate helped to make possible the utilization of undeveloped areas.² Dry-farming is practiced where irrigation can not be carried on or where it is not practical to attempt it. It is not farming without moisture but farming with insufficient moisture.

Cultivated land in Utah.--Although the state of Utah comprises an area of 52,597,760 acres, only 11.9 per cent of it was in farms in 1935, and but 3.2 per cent of the land of the state was available for crops.³ It is estimated that not more than 5 per cent of the total area of the state will ever be cropped. Variable light rainfall uncertain in distribution, rough land and steep slopes, thin soil, and alkali are factors which preclude the use of a large additional acreage. Eighty-one per cent of the cultivated area was irrigated in 1929, and about 19 per cent or 290,000 acres were utilized for dry-land crops.⁴ Since a large percentage of the dry-lands is left fallow each year, the total amount of land devoted to dry-farming is much greater than this. An estimate of 466,000 acres of land suited to dry-farming, about 1 per cent of the area of the state, was given in a United States Geological Survey Report in 1932.⁵

Crops raised on the dry-lands.--While it is possible to raise a large variety of crops by dry-farm methods, only a few are produced in quantity. The distribution of rain with a spring

¹William Macdonald, Dry-Farming (New York: Century Co., 1911), p. 6.

²William Prescott Webb, The Great Plains (New York: Ginn & Co., 1931), pp. 372, 373.

³United States Department of Commerce, United States Census of Agriculture: 1935, Utah Statistics by Counties, First Series (Washington: Government Printing Office, 1935), p. 6.

⁴United States Department of Agriculture, Fifteenth Census of the United States: 1930, Utah Statistics by Counties, First Series (Washington: Government Printing Office, 1931), p. 6.

⁵John F. Deeds and Depue Falck, Land Classification Report for Utah, Geological Survey, United States Department of Agriculture (Washington: Government Printing Office, 1932), p. 15.

maximum, and the fact that greater profits are derived from wheat production than from any other crop make wheat the dominant crop on the dry-lands. Alfalfa, the crop second in importance, covered an acreage only about 30 per cent as large as that of wheat in 1929 (Fig. 2).

Crop	Acres Harvested	
	1929	1934
Wheat.....	169,380	136,323
Alfalfa hay.....	49,487	40,320
Tame hay (excluding alfalfa).....	6,914	4,790
Barley.....	5,617	4,650
Oats.....	3,686	2,560
Corn.....	2,674	3,610
Rye.....	2,243	2,247
Total.....	240,001	194,480

Fig. 2.--Acreages of major crops raised on dry-lands. (Figures for 1929 from Fifteenth Census of the United States: 1930. Figures for 1934 estimated from data supplied by Frank Andrews, Department of Crops and Livestock Estimates of the Bureau of Agricultural Economics, Salt Lake City, Utah, on a basis of the percentage of crop raised on non-irrigated land as given in the 1930 Census.)

Utah's rank in the production of wheat.--In comparison with other states of the union, Utah does not rank high in the production of wheat. The average acreage for the years 1924-1930 was 246,000, ranking it twenty-seventh.

Northern and central Utah and southeastern Idaho comprise the intermountain commercial wheat region and together produce annually approximately 20 million bushels of wheat.¹ This is a small surplus area which ships wheat east, west, and southwest. An estimate of the uses of wheat in Utah gives approximately 1,137,000 bushels or about 21 per cent of the crop as the average yearly exportable surplus for the years 1924-1929.²

¹Federal Farm Board and Utah Agricultural Experiment Station, "Wheat Compendium, 1930" (mimeographed), Foreword.

²Aaron F. Bracken, "Cereal Crops," Utah Resources and Activities (Salt Lake City: State Department of Education, 1933), p. 282.

Importance of wheat production within the state.--In striking contrast to the relatively small amount of wheat produced by the state is the great importance of wheat production within the state. The wheat acreage is greater than that of any other crop except hay. In 1934 wheat was harvested on 201,158 acres, 17.1 per cent of the cropped area of the state, while hay occupied 52.1 per cent of it. In 1930 the largest single cash income from any crop was derived from the sale of wheat.¹ Wheat is produced in all the counties of Utah except Grand County and in several sections wheat growing is the dominant farm enterprise (Figs. 3, 4, 5, 6).

Winter and spring wheat.--In Utah winter wheat and spring wheat are produced in almost equal amounts, the greater part of the winter wheat being raised on the dry-lands and the spring wheat on irrigated land. Since the yield of winter wheat is low, its acreage is almost double that of spring wheat (Fig. 7).

Counties important in the production of unirrigated wheat.--The counties which figure most prominently in the production of unirrigated wheat lie in the northern and central part of the state where 93 per cent of the cultivated dry-land acreage is located. Three counties, Box Elder, Cache, and Juab, planted about 76.2 per cent of the dry-land wheat acreage in the period 1929-1931 and Box Elder alone contributed 42.5 per cent.²

Factors influencing the distribution of dry-farm regions.--The distribution and type of dry-farm areas, to a large extent, depend upon two factors: the amount and distribution of rainfall and proximity to a railroad. The average rainfall for the state is 12.87 inches.³ That this figure gives little clue to real conditions at a given place is apparent when rainfall data for different stations are compared.

The amount of rainfall varies greatly and irregularly from place to place because it is modified by the proximity, height

¹W. Preston Thomas, "Economic Factors," Utah Resources and Activities, p. 252.

²From data furnished by Frank Andrews, Department of Crops and Livestock Estimates of the Bureau of Agricultural Economics, Salt Lake City, Utah.

³This is a twenty-six year mean for the state (1893-1918) (J. C. Alter, "Normal Precipitation in Utah," Monthly Weather Review, September, 1919, p. 636.)

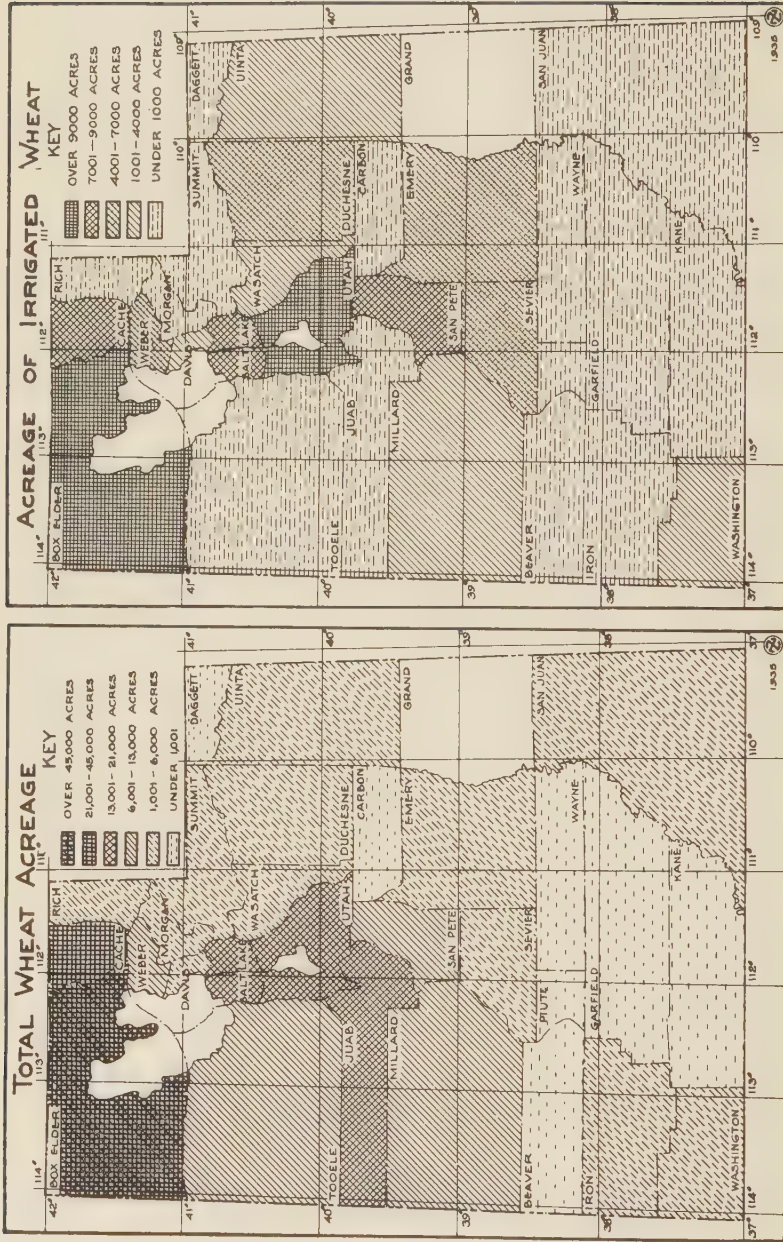


Figure 3

Figure 4

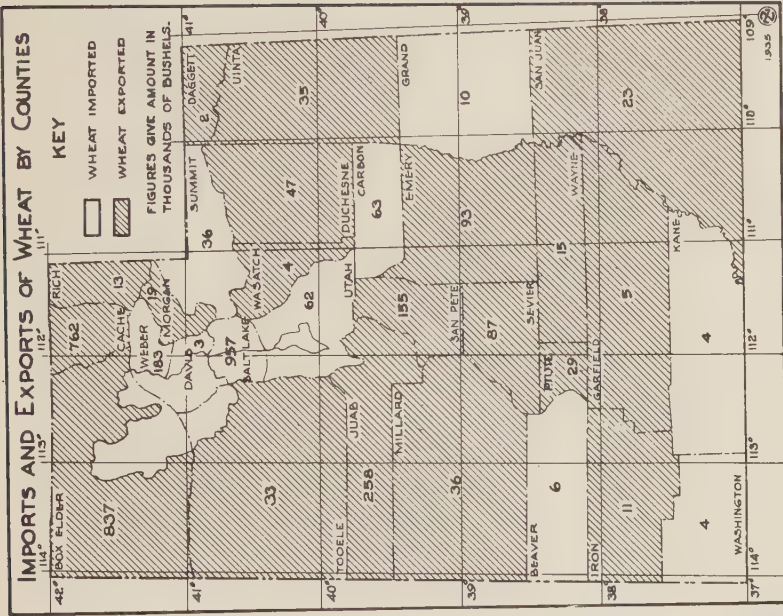


Figure 6

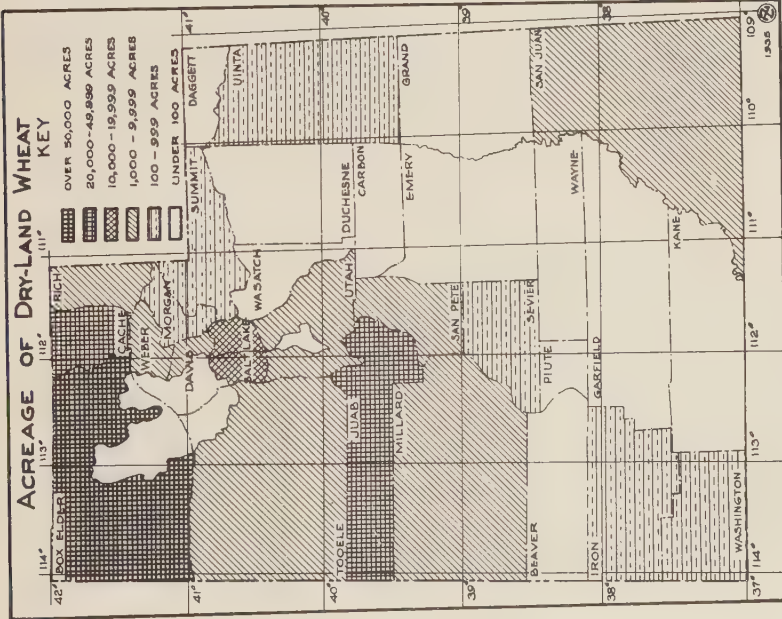


Figure 5

Variety	Acreage	Acre Yield Bushels	Production Bushels	Percentage of Total Production
Winter wheat.....	154,680	19.1	2,947,230	54.0
Spring wheat.....	84,942	29.6	2,510,530	46.0
Total.....	239,622	....	5,457,760	100.0

Fig. 7.--Average annual production of wheat in Utah, 1924-29 inclusive (From Bracken, Utah--Resources and Activities, p. 281).

and relative position of nearby mountains.

Since the rainfall of Utah is so light, farming must be carried on either by irrigation or special methods. Dry-farming is the result of scientific efforts to overcome this handicap of light rainfall. Where similar conditions in regard to railroad facilities and the amount and distribution of rainfall exist, as in the central and northern parts of the state, the regions themselves are similar. Southern Utah suffers from a lack of railroad services and differs from the rest of the state in the distribution of its rainfall. Therefore, two major types of dry-farming have developed, the cash-grain wheat farms of northern and central Utah and the subsistence farms with many crops in the south.

PART II

ESTABLISHMENT AND DEVELOPMENT OF THE INDUSTRY

Many factors helped to make possible the establishment and development of dry-farming in Utah. Some of these influences worked indirectly and were a part of the general land policy of the United States. Among such may be counted the passage by Congress of several acts such as the Morrill, Hatch, Adams and Purnell Acts which provided for the establishment of technical agricultural schools and the carrying on of agricultural research work, the founding of the Bureau of Plant Industry, and the organization of

the Office of Dry-Land Agriculture which carries on investigations in conjunction with various State Experiment Stations.¹ Scientific knowledge from these institutions, aided by recently invented labor-saving machinery, made possible the farming of large units of low-priced land formerly not cultivated.²

Section 1. Establishment of Dry-Farming

The immediate cause for the establishment of dry-farming was an urgent need for more arable land. Although the area irrigated in Utah increased 138.8 per cent between the years 1890 and 1900 and 58.8 per cent between 1900 and 1910, and although large numbers of farm people migrated from Utah to Canada, Mexico, Idaho and neighboring states during these years, still the building of irrigation canals did not keep pace with the demands for more farm land.³ In addition to this the cost of raising cereals by irrigation was so great that a fair return on the capital invested and the labor expended was not possible. These facts led to the consideration of dry-farming.

Some farmers, because they believed crops would grow in Utah without irrigation or because they disliked the additional labor and expense of applying water, made attempts to produce crops without it. Such attempts to grow wheat were begun in the early fifties. A few succeeded, but, because they were made on lands usually irrigated and with varieties of wheat which were accustomed to water, most of them failed.⁴

As far back as the 1860's Brigham Young, with his usual foresight, said frequently that the wheat fields of the future would be found above the lines of the high canals.⁵ He designated certain unirrigated areas which, he said, would be devoted in the

¹See H. D. Leppan, The Agricultural Development of Arid and Semi-arid Regions (Johannesburg, South Africa: Central News Agency, 1928), pp. 212, 213.

²Bernard De Voto, "The West, A Plundered Province," Harper's Monthly Magazine, August, 1934, pp. 357, 358.

³"Irrigation of Agricultural Lands--Utah," Fifteenth Census of the United States, p. 5.

⁴Webb, op. cit., p. 368.

⁵James A. Leishman, "Dry Land Farming and Farmers," Deseret Farmer (Salt Lake City), December 8, 1904, p. 1.

future to raising wheat, among them being Levan Ridge in Juab County and the west side of Cache Valley in Cache County, both of which are important dry-farm regions today.

Early successful attempts to farm without irrigation.--

Probably the first successful dry-farming on a large scale was carried on in 1863. A group of immigrants, mostly from the Scandinavian countries, had settled in Bear River City in Box Elder County, using water from the Malad River to irrigate their crops.¹ This water carried large quantities of alkali and impregnated the land with noxious salts to such an extent that after a few years it was unfit for crops. In despair, these people plowed up the sagebrush and planted crops above their old fields, meeting with considerable success. "This was the first great victory for dry-farming in the state of Utah."²

Father Christopher Layton successfully tried dry-farming on the Sand Ridge between Ogden and Bountiful. In various other parts of the state similar experiments in farming without irrigation were carried on. The results were meagre at first, but after a few years' trial with better methods they often proved successful.

Successful attempts at dry-farming were conducted in Cache County in the sixties and seventies, in Juab County in the seventies and later, and in San Juan in the late eighties.³ The greatest success was achieved, and the greatest number of experiments were carried on in the northern part of the state. South of Salt Lake City farming without irrigation was seldom tried, and little interest was manifested in it.

Investigations.--Use of the dry-lands was under discussion by the members of the Utah Experiment Station at Logan from 1895 to 1901. In 1901 a systematic study was made by Dr. Widtsoe and Mr. Merrill, who spent a large part of the summer investigating conditions throughout the state where dry-farming was being carried

¹J. W. Powell, Report on the Lands of the Arid Region of the United States, 1877, United States Geographical and Geological Survey of the Rocky Mountains (Washington: Government Printing Office, 1879), p. 78.

²Macdonald, op. cit., p. 26.

³Ibid.: "It was only, however, as the rivers passed into private ownership, and the population increased that the people themselves seriously turned to dry-farming."

on successfully. At the same time a study of climatic conditions in Utah was carried on in order to determine where the industry could be introduced or extended. It was concluded that dry-farming could be pursued over large areas then unused, or used only for grazing, south as well as north of Salt Lake.

Establishment of experimental farms.--As a result of the findings of Widtsoe and Merrill the state legislature of 1903 made an appropriation of \$12,500 for the establishment and maintenance of experiment farms, the work of which was to be supervised by the Utah State Experimental Station at Logan.¹ A committee was appointed to select sites for these farms. Six forty-acre farms were chosen and experimental work was begun.

With the establishment of these stations interest in dry-farming immediately spread over the state. Near these farms, especially, enthusiasm ran high and large stretches of sagebrush were plowed and planted to wheat. Some of the land was homesteaded, farm units of 160 acres being available, but much land was bought from the state at \$1.25 an acre.

Section 2. Development of the Industry

Economic pressure, together with high-powered salesmanship and enthusiasm unrestricted by a knowledge of the inherent limitations, caused the new industry to develop rapidly. Several years of unusually heavy rainfall and war prices furthered this development.

Aids.--One very important aid in advancing the industry was co-operative farming. This habit of working together had already been developed because of isolation and the severity of the climate. It was expressed in mining codes, laws of real estate and water rights, and the co-operative building of roads, bridges and irrigation works.²

¹Ibid., p. 32: "It is to the State of Utah that the honor belongs of having first established and successfully maintained a series of dry-land experiment stations."

²De Voto, op. cit., pp. 360 and 364; Lowry Nelson, "The Mormon Village: A Study in Social Origins," Proceedings of the Utah Academy of Sciences, VII (1930), 27; Lowry Nelson, A Social Survey of Escalante, Utah, Brigham Young University Studies No. 1 (Provo, Utah: Brigham Young University, 1925), pp. 3, 43.

Co-operative farming.--The greatest profit in dry-farming normally is made by large-scale operations and the use of expensive machinery, making necessary a large initial investment. To meet this financial need arid-farm companies were formed in many counties for the purpose of co-operative buying of machinery and supplies. These companies owned farms varying in size from 1,000 to nearly 10,000 acres. For the most part they did not continue long, the land later being sold to individuals.

The State and Federal Governments also gave assistance, the state by continuing experimental work and sinking wells in five counties, the Federal Government by making large tracts of land available for homesteading, and by financial aid in the form of seed loans and loans from the Federal Land Bank.¹ Among other helpful factors were State and International Dry-Farm Congresses and publications, such as, the Utah Farmer, a farm magazine, Dr. Widtsoe's book on Dry-Farming, and bulletins on dry-farming issued by the State Agricultural College.²

Securing lands.--With so much enthusiasm for the new type of farming and so little accurate knowledge of natural conditions throughout the state extensive areas entirely unsuited to dry-farming were filed upon and farmed. Large land companies advertised extensively and railroads urged people to homestead along their lines.

Native vegetation.--That native vegetation indicated the suitability of land for dry-farming was recognized from the beginning. At first any land producing sage (Artemisia tridentata) was thought suitable for wheat. Typical sagebrush soil is well-drained, usually deep and practically free of alkali. But the mere presence of sage is not enough. The height and vigor of growth must be considered. Today the presence of thrifty sagebrush is used as an indicator of proper soil conditions, and dry-farming may be carried on where it is found, if the moisture and temperature permit.

Success.--By 1914 it was realized that dry-farming had not made the progress that was expected by some and that it had

¹Bowman, op. cit., p. 51.

²F. D. Farrell, "Dry Land Grain Production," Utah Farmer, April 22, 1911, p. 1.

"suffered from the overemphasis and misrepresentation of land boomers and speculators."¹ Nevertheless the outlook for the future was thought to be full of promise for rapid development. Some of the restrictions of the industry were becoming apparent, however, and by 1930 it was recognized that aridity imposed definite limitations upon both irrigation and dry-farming.²

Abandoned lands.--Unsatisfactory yields have resulted in the discontinuance of dry-farming in various parts of the state.³ The abandonment of these sections has resulted generally because of unsatisfactory natural factors, among which insufficient rainfall and shortness of the growing season are most important. After a few fruitless years, whole areas were vacated. This was especially true in all the western counties of the state. Similarly, lands in Kane, Garfield, Piute, Carbon, and Emery counties have been deserted. Attempts to dry-farm at high altitudes in Garfield and Sanpete counties were discontinued because of the shortness of the growing season. On the other hand, deserted homesteads in San Juan County reflect low wheat prices and long distance from railroads.

Wheat acreage.--The amount of land in Utah planted in wheat increased gradually until 1890 and then experienced a rapid expansion, reaching its greatest area in 1916. Demands to fill war requirements and high prices paid for wheat resulted in an expansion of the wheat acreage by the cultivation of the cheaper dry-lands giving low yields. The wheat surplus with its consequent low prices and recent years of scant rainfall have resulted in a decrease in the acreage planted. From 1916 to 1930 the decrease in Utah amounted to 17 per cent.⁴ In 1934 wheat was harvested from 201,158 acres, a decrease of 16 per cent from the average area harvested from 1924 to 1929.⁵

¹Webb, op. cit., p. 373.

²P. V. Cardon, "Utah Agriculture, Eighty-three Years Old," Utah Farmer, March 25, 1930, p. 4; De Voto, op. cit., p. 364.

³Leppan, op. cit., p. 224.

⁴Bracken, Utah--Resources and Activities, p. 278.

⁵Ibid., p. 279, and Census of Agriculture for 1935.

PART III

TWO TYPES OF DRY-FARM REGIONS IN UTAH

In appearance there are two types of dry-farming regions in Utah. The dissimilarity in their aspect is partly due to differences in native vegetation. Regions in northern and central Utah devoted to this industry are nearly level lands formerly covered with sagebrush. When cleared, these lands are entirely covered with wheat fields. In southern and eastern Utah a thick growth of trees still covers much of the land and conceals most of the scattered cultivated spots.

Section 1. The Levan Ridge, a One-Crop
Dry-Farm Region

The Levan Ridge in Juab County is located almost in the center of the state. This small dry-farm area lies in the southern part of Juab Valley, occupying most of the land between the towns of Nephi and Levan which are approximately eleven miles apart (Fig. 8).

Description of the Levan Ridge.--In structure the Levan Ridge is an alluvial fan, or more correctly a series of alluvial fans which coalesce.¹ In area it is about six miles long and from three and one-half to four miles wide, embracing roughly twenty-four sections of land or approximately 15,000 acres. The highest part of the fan, the center at the east, has an altitude of 5,800 feet. From here it slopes gently to the west, north and south. The north end, its lowest part, is 5,100 feet in altitude. Of the 15,007 acres on the Ridge, 13,464 acres are being dry-farmed.² Because of rocky and sandy soil, or rough topography, most of the remaining land is classified as "other" or grazing land.

Significance.--Today this is the best known dry-farm region in Utah. This is due, for the most part, to the fact that a dry-

¹For geology of the region see C. E. Dutton, "Geology of the High Plateaus of Utah," United States Geographical and Geological Survey of the Rocky Mountain Region (Washington: Government Printing Office, 1880).

²Data from 1932 Assessment Rolls for Juab County, County Assessor's Office, Nephi, Utah.

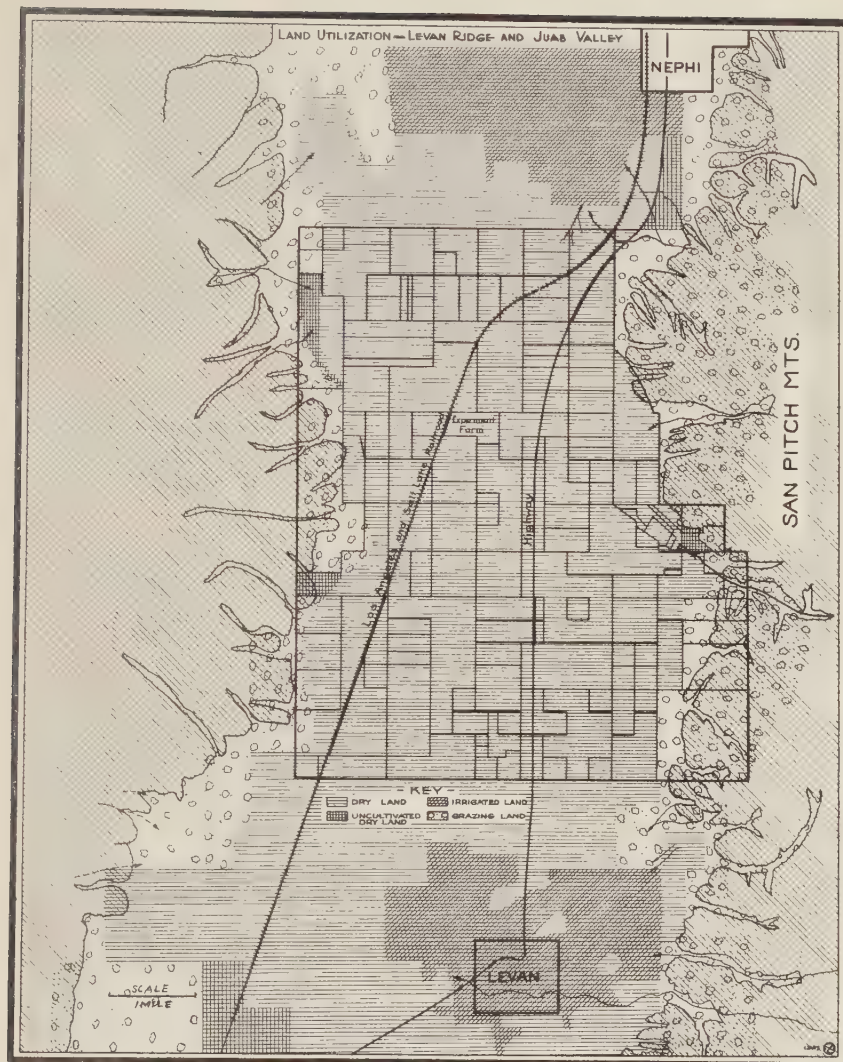


Figure 8

farm experimental station has been maintained there continuously since 1903. Because of this farm, practices on the Ridge are uniform and progressive. In addition, it is a small compact area, located on a main line railroad connecting the region with a sea-board market. Neighboring counties furnish smaller local markets. Natural factors, too, in the form of deep clay loam soil and rainfall sufficient for dry-farming have aided in making the Levan Ridge outstanding.

Advantages.--The Levan Ridge dry-farm region is favored in many ways. Not only are the physical conditions conducive to raising crops without irrigation but many cultural factors also are favorable.

Natural assets.--The most important consideration in dry-farming is the amount of moisture available for plant use. Therefore, the chief requirements necessary to carry on dry-farming are a proper amount of rainfall and a deep soil with a large water-storage capacity.

The generalization is often made that dry-farming should not be attempted in Utah where the average rainfall is below 12 inches. The average on Levan Ridge for 35 years, as recorded at the station on the top of the Ridge, is 12.75 inches, 48 per cent of which falls in the first five months of the year. Other months of relatively heavy rainfall are August and October (Fig. 9). For winter wheat there are two periods when moisture is especially necessary, in the fall at planting time, and in the spring when the plant is making its vegetative growth. The average rainfall on the Ridge and its normal distribution with a spring maximum and moderate rain in the fall are fairly well adapted to the pro-

J	F	M	A	M	J	J	A	S	O	N	D	An- nual
1.07 ^a	1.14	1.46	1.27	1.56	0.58	0.83	1.03	0.85	1.12	0.86	0.98	12.75
1.34 ^b	1.37	1.78	1.51	1.68	0.50	0.86	1.08	1.10	1.24	1.07	1.29	14.82

^aExperiment Station.

^bLevan, Utah.

Fig. 9.--Average rainfall at experiment station on Levan Ridge and at Levan, Utah. (Figures for the 35-year period 1898-1932 inclusive, furnished by United States Weather Bureau, Salt Lake City, Utah.)

duction of this crop. In common with other semi-arid regions, however, this district suffers from wide fluctuations both in the amount of rain and in its distribution. As a result there are great differences in yield from year to year. Records for 26 years kept at the experiment station show yields of wheat ranging from 5 to 42 bushels per acre.

Not all of this variation in yield is due to rainfall. Other climatic factors are also important, such as: evaporation, April temperatures, winter snow-covering, amount of run-off, and date of last spring frosts. In general, however, climatic conditions on the Levan Ridge are adapted to the production of dry-land wheat.

There are two major soil types in Utah: (1) the soils of the Great Basin; (2) the soils of the Colorado Plateau. Great Basin soils are formed primarily from limestone and, therefore, are rich in lime, have a loose, open structure and are easy to till.¹

Although structurally not a part of the Great Basin, the Levan Ridge has soils similar to Great Basin soils. In general, it has a very deep clay-loam soil (Fig. 10). Of particular significance is the fact that the soil carries a substratum of rather heavy blue clay which has an exceptionally high moisture-holding capacity. These soils contain sufficient amounts of phosphorus and potassium, but like all arid soils they contain little nitrogen.² By observing the fallow year, adding organic material in the form of straw and furnishing better moisture conditions, the amount of nitrogen in them is being increased slightly.³

Cultural items.--A very important advantage which the Levan Ridge possesses is good transportation facilities. The former main line of the Los Angeles and Salt Lake Railroad, which is still used for regular freight and passenger traffic, crosses the Ridge itself and connects Nephi with Salt Lake City and Los

¹Don W. Pittman, "Soil," Utah Resources and Activities, pp. 301, 302.

²John A. Widtsoe and Robert Stewart, The Nature of the Dry Farm Soils of Utah, Utah Agricultural College Experiment Station, Logan, Utah, Bulletin 122, 1913, pp. 275-79.

³Experiments conducted at the Utah State Agricultural College at Logan have shown this to be true.

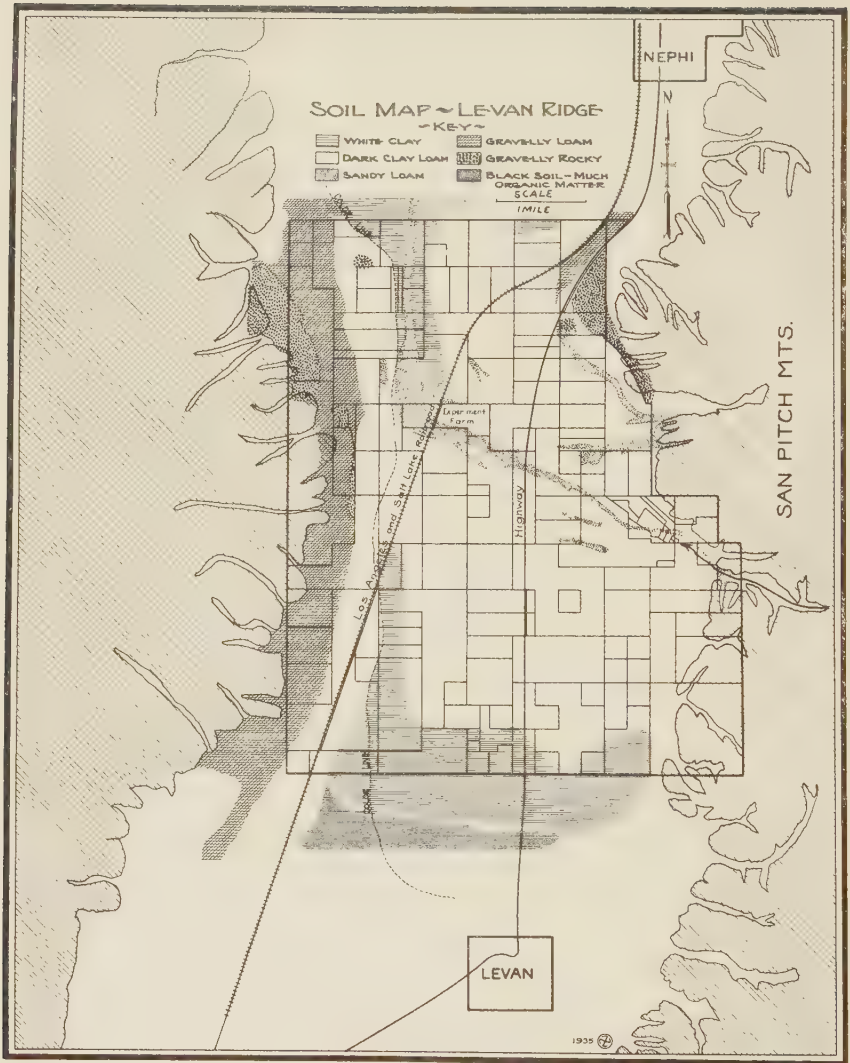


Figure 10

Angeles. This has made possible the shipment of wheat direct from the Ridge to Southern California. United States Highway No. 91, a paved road and the route most commonly used between Salt Lake City and Los Angeles, also crosses the Ridge. Other highways afford access to towns east and west of Nephi.

Location.--Another important advantage is that of location. Nephi lies approximately ninety miles south of Salt Lake City. Since this is a wheat-exporting community, its location relative to California, to Ogden, Utah, the grain market for northern Utah and southern Idaho, and to local markets is of greater importance than its central location or distance from Salt Lake City.

Location in regard to markets.--Two types of markets are important to wheat growers in Juab County: (1) distant markets, (2) local markets.

The basic point upon which the schedule of prices is built for the intermountain region is the locality which demands the wheat. Generally for hard wheat this is California, which has an import price, tending to fluctuate with prices in eastern markets. Since a large proportion of the wheat imported in California comes from the Pacific Northwest, the price of California wheat moves more closely with that of Portland than it does with that of any other place in the United States. The value at Portland, due to the large volume of white wheat exported from that region, reflects the world wheat price established at Liverpool.¹ This price often determines the amount paid for wheat in Utah.

Wheat from Levan Ridge may move by rail, north to Ogden, or southwest to southern California. Southern California is, however, the natural outlet for wheat from the Levan Ridge and unless there is a shortage at Ogden the wheat normally moves direct to California. This is done to avoid paying the freight rate of 17.5 cents between Nephi and Ogden.

In normal years the Ridge formerly shipped from 40 to 65 carloads of wheat per year to California, which needs hard wheat to mix with its own soft wheat for flour making. Formerly on a surplus wheat basis California has recently shifted to a deficiency basis.

¹Elmer W. Braun, Background Studies as a Basis for Regional Outlook Statements (New York: Columbia University, 1934).

A large percentage of the wheat is used in the immediate locality of Nephi and Levan and in other nearby markets. The two mills of the Juab County Mill and Elevator Company in Nephi, one of which is a grist mill, furnish a local outlet for wheat.¹

Many counties of Utah do not produce wheat enough for their own needs. Others produce more than they need but not always of a kind required by the market. Box Elder, Cache, and Juab counties are large exporters of wheat (Fig. 6). Sanpete, Sevier, and other counties export soft wheat but sometimes import hard wheat (Figs. 4, 5, 6). Thus Levan Ridge has another local market for its surplus.

A marked change has taken place recently, in marketing the Juab wheat. Since 1930 a yearly average of only 7 cars of wheat has been shipped by rail from the Levan Ridge and neighboring farms. In 1930, 89 cars left this section.²

Various reasons for this change have been given, among which are: (1) decrease of wheat production in the region due to drought; (2) increased use of trucks in shipping; (3) building of a co-operative warehouse in Nephi by the Farmers National Grain Corporation; and (4) increased local demand. Probably all of these factors have helped to cause a decreased shipment of wheat by rail.

The average yield per acre for the years 1930-1932 was about 16 bushels.³ It has been estimated that 22 bushels per acre were average for the Ridge preceding the drought period. The difference in production between these years and normal years was approximately 35,500 bushels or 24 carloads. Decrease in wheat production alone does not account for the large difference in the number of cars shipped in 1930 and those shipped in the succeeding three years.

Shipping wheat by trucks instead of by rail has become a

¹In 1931, 76,800 bushels of wheat were ground in these mills, producing 17,000 barrels of flour. Of this amount 70,000 bushels were dry-land grain, most of it from the Ridge, and they constituted 70 per cent of the 1931 crop. Data furnished by A.H. Belliston, manager of Juab Mill and Elevator Co., November, 1932.

²Data furnished by the auditor of the Los Angeles and Salt Lake Railroad, September 30, 1935.

³Yields, figured from reports to the Wheat Allotment Committee for Juab County.

common practice in all parts of the state. This method of transportation has two advantages; first, the farmer himself can do the hauling during the late fall and winter months, when he is not otherwise employed, and thus can save the freight rate, and second, he can hold his wheat for a higher price. Farmers throughout the state have been greatly interested in storing their wheat and waiting for an opportune time to sell. The practice of holding wheat on the farm is not always profitable, but in 1932-33 this holding policy paid the farmer.

In 1930 the Farmers National Grain Corporation opened a warehouse in Nephi and also leased the Globe Milling and Elevator Company's elevator on Levan Ridge. This corporation operated the warehouse until September, 1934, when it was taken over by a co-operative company of wheat growers living in the vicinity of Nephi.

From 1930 to June 1935 the Globe Grain and Milling Company, with flour mills in Ogden, Utah, and several cities in California, did not buy any wheat in that section. Nor was any wheat bought there by the Sperry Mills which also have mills in Ogden and California. Beginning in July, 1935 the Globe Grain and Milling Company began operating again. Because of the light weight of Ridge wheat that year and a demand for wheat and flour in the middle west, the Globe Mills shipped 25 carloads to Ogden and Kansas from this district.¹

During the years 1931-1935 wheat was trucked north to flour mills lying between Nephi and Salt Lake City, to mills in San Pete Valley and still farther east to those in the towns of Price and Huntington. Poultry men formerly demanded only soft wheat but a recent change of opinion as to the merit of hard wheat for chicken feed has opened new markets in the poultry-producing sections of Utah for the producers of hard wheat.

Location of homes of Ridge land owners.--The owners of the Ridge lands for the most part live in the towns of Nephi and Levan, which lie immediately north and south of the Ridge. In 1930 these small agricultural towns had populations of 2,987 and 611 respectively. Within the towns each householder owns a city

¹This company formerly bought from 50,000 to 75,000 bushels of wheat in the Juab County district and the Sperry Mills about 30,000 bushels. Information from these mills, October, 1935.

lot, large enough to include a garden and fruit trees.¹ The irrigated fields lie southwest, west, and northwest of the towns. Here hay, grain, and native wild grass are grown. Within the towns themselves are several apple orchards which furnish fruit for shipment. Nephi lies upon an alluvial fan formed by Salt Creek, and Levan is located upon a debris apron formed where Pigeon and Chicken creeks enter Juab Valley. Between these fans and the one on which the Ridge is located are narrow strips of lower land called swales.

In Nephi reside ninety owners who together hold 11,579 acres, 87 per cent of the land. Eleven residents of Levan own 711 acres and 978 acres are in the possession of former residents of these two towns. The Levan owners farm all but 40 acres of their land and they also farm 120 acres of those who live elsewhere, or 791 acres in all. This land lies at the southeast end of the Ridge about two miles north of Levan. One hundred twenty-eight acres are still held in the names of four former owners who are dead, but this land is worked by Nephi residents.

Included in the list of owners are the Utah Agricultural Experiment Farm with 142 acres, and two organizations of the Mormon church which farm 331 and 158 acres respectively. The state leases 94 acres and the First National Bank of Nephi, 130 acres. There are also two unfarmed pieces of one acre and one and three-quarters acres. The latter piece, part of a former stream bed, furnished gravel for building the highway and is owned by the county.

Land units.--Dry-farming, with its comparatively low yields and half its land idle each year, is usually associated with the thought of extensive holdings and large fields, yet this is hardly true on Levan Ridge.

Size of holdings on Levan Ridge.--The 15,007 acres of land I have designated as the Ridge are divided into 156 parcels of land held in the name of 122 people or groups of people. The average size of the separate fields is 96 acres and the average number of acres owned by each person is 123. The land is actually controlled by only 109 groups because of combination ownerships within families and the average number of acres owned per family is 137. In general terms, one-fourth of the farmers own

¹Lowry Nelson, Survey of Escalante, pp. 3-5.

Lowry Nelson, The Mormon Village, p. 11.

on the Ridge 40 acres or less, over half of them own 80 acres or less, and three-fourths of them own 160 acres or less (Fig. 11).

Acres	1916				1932				
	Persons		Acres		Groups			Acres	
	No. Own-ing	% Own-ing	No. Owned	% Owned	No. Own-ing	% Owning		No. Owned	% Owned
						Indi-cated Acreage	Indi-cated Acreage and Less		
Over 999.	1	1.0	1,360	10.4	0	0.0	0.0	0	0.0
500-999..	2	2.0	1,691	12.9	3	2.7	99.9	1,804	12.0
330-499..	0	0.0	0	0.0	6	5.6	97.2	2,282	15.2
260-329..	3	3.9	920	7.0	6	5.6	91.6	1,727	11.5
175-259..	6	5.9	1,271	9.7	11	10.1	86.0	2,431	16.2
100-174..	28	27.5	4,100	31.5	22	20.1	75.9	3,323	22.1
50- 99..	39	38.2	2,886	22.1	32	29.3	55.8	2,461	16.4
20- 49..	21	20.6	808	6.1	25	22.9	26.5	923	6.1
Under 20.	1	1.0	10	0.1	4	3.6	3.6	56	0.4
Total..	102	99.2	13,046	99.8	109	99.9	....	15,007	99.9

Fig. 11.--Size of dry-farm holdings on Levan Ridge*

*Data from Juab County Assessment Rolls for 1916 and 1932.

This relatively small land unit bears out the fact that dry-farming in Utah frequently is supplementary to other means of obtaining a living.

Fields.--The smallness of fields is not apparent as one looks across the Ridge because barbed wire fences do not stand out distinctly against stubble or fallow ground, and, in addition, since horses are used less than formerly, not all the separate fields are surrounded by fences. With only a few exceptions where the highway and railroad have been used as boundaries, the fields are rectangular in shape. The smallest fields occur at the southern end of the Ridge where they were obtained from the state in forty-acre plots, and where white clay soil makes farming difficult. The largest entirely cultivated fields on the Ridge contain 480, 440, 403, 331 and 320 acres and comprise land of highest value.

Lessees and workers of farms are not necessarily the owners of neighboring fields so that it is quite common to find operators farming land on different parts of the Ridge. In addition, the lands of twenty-three farmers are separated, the largest owner holding land in five divisions. This separation of fields is common in Utah and is due to the manner of procuring land.

Manner of acquiring the Ridge lands.--The land as now owned was obtained in one of four ways, (1) by homesteading, (2) by buying from the state, (3) by buying from an individual and (4) by inheritance. Only about 15 per cent of the land was homesteaded. The remainder was at one time or another bought from the state, much of it at \$1.25 per acre but some at a price of \$2.50 to which the State Land Board raised the price in 1906.¹ At present about 15 per cent is still held by the original owners; the rest has changed hands either through sale or inheritance. Owners of the larger acreages have acquired their holdings by inheritance or by purchase when opportunities for such were available. The price paid to individuals varied from near the level of the price paid the State Land Board to as high as \$75 an acre for a small tract and \$65 and \$55 an acre for larger ones. The price depended somewhat upon the land itself but chiefly upon the market at the time of sale. The peak prices were obtained near the end of the war when wheat was greatly in demand, and during the recent years of 1926 to 1930.

Reasons for acquiring the land.--When it was found possible to produce wheat commercially upon the Ridge, residents of Nephi hastened to secure land. Some of these people already owned irrigated lands near the town and homesteaded or bought dry-lands because dry-farm practices fitted in well with their other farm labor and at the same time permitted further use of horses and machinery already owned. Others secured land on the Ridge because they were unable to buy irrigated land or to obtain it cheaply enough, or because they considered this type of farming simpler and easier than irrigated farming, which required more nearly constant work (Fig. 12).

Land values.--Assessed values of dry-land on the Ridge range from about \$5.00 an acre to \$25.00 an acre (Fig. 13). Since

¹ See George Stewart, "Land Ownership and Utilization," Utah Resources and Activities, Chap. IV.

the assessed value of dry-land on Levan Ridge is about 60 per cent of the selling price, probable real values in 1932 ranged from \$7.50 to \$30.00 per acre.

WORK SCHEDULES													
	KEY	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
IRRIGATED LANDS	PLOWING				P L O W I N G								
	PLANTING			BARLEY OATS		ALFALFA CORN							
	HARVESTING						ALFALFA		ALFALFA	SPRING GRAM ALFALFA			
DRY LANDS	PLOWING					P L O W I N G			WEEDING			P L O W I N G	
	PLANTING										W H E A T		
	HARVESTING								W H E A T				

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Fig. 12.--Work schedules on dry-farms and irrigated farms

Land values are closely related to soil types. Grade A land occupies dark clay loam while poorer grades are found on gravelly rocky loam along the hill sides, and on the heavy white clay at both the north and south ends of the Ridge. Land lowest in value lies at the southwest edge and is subject to late spring frosts (Fig. 10 and 14).

Land values are also closely related to yields. Most of the lands of highest value produced an average of 18 bushels or more per acre for the years 1930-1932, and most of the lower grades less than 14 bushels per acre (Fig. 15).

Mortgaged land.--The list of land owners on Levan Ridge in 1932 was singularly free from names which indicated that the land has been taken over by organizations to which money was due, such as: the state, county, private banks, or the Federal Land Bank of Berkeley. Only two such names occurred. Nevertheless, much of this dry-farm land is mortgaged, some of it for as much as, or more than its value in 1932. According to records in the Juab County Recorder's Office at Nephi, 56 per cent of the land was mortgaged. These mortgages ranged from \$1.50 to \$44.00 per acre. More large than small holdings were mortgaged, but more of the lower-valued lands were mortgaged for an amount larger than the assessed value.

Farm practices.--The presence of the Experiment Station in the region has greatly affected farm practices, resulting in the use of improved methods by these farmers and nearly identical

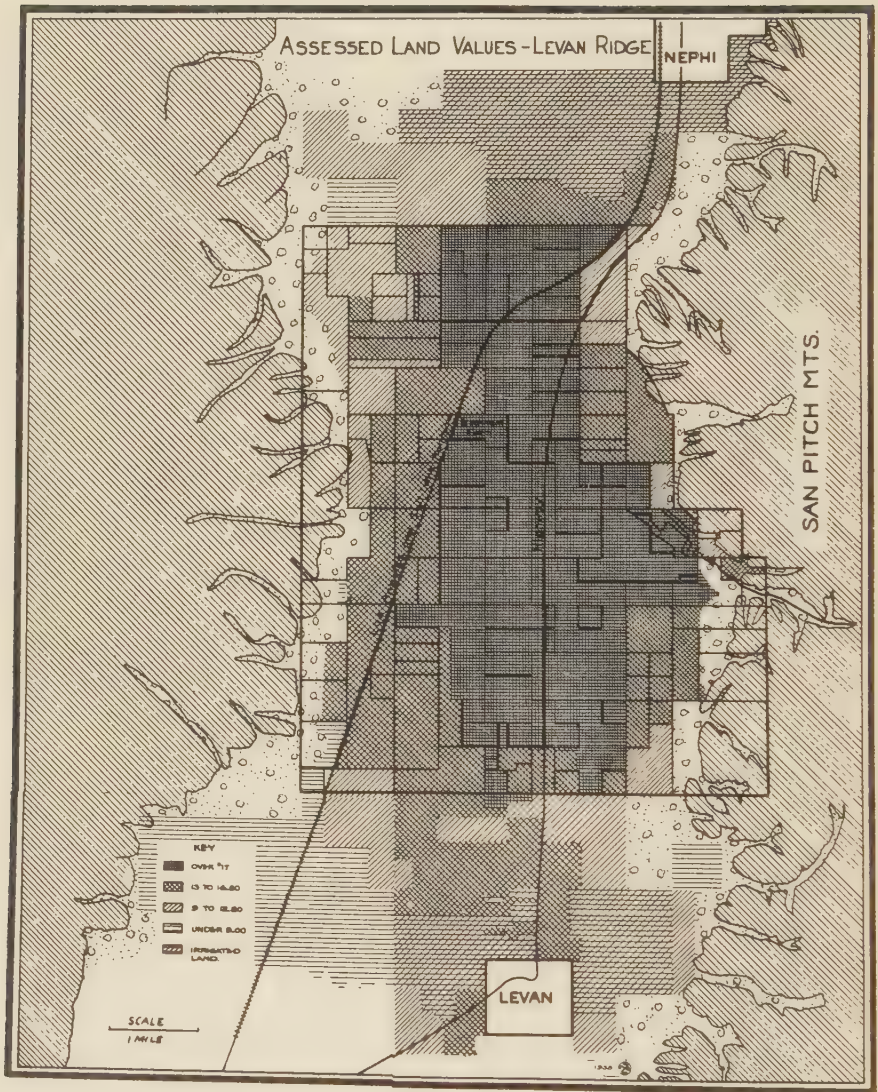


Figure 13

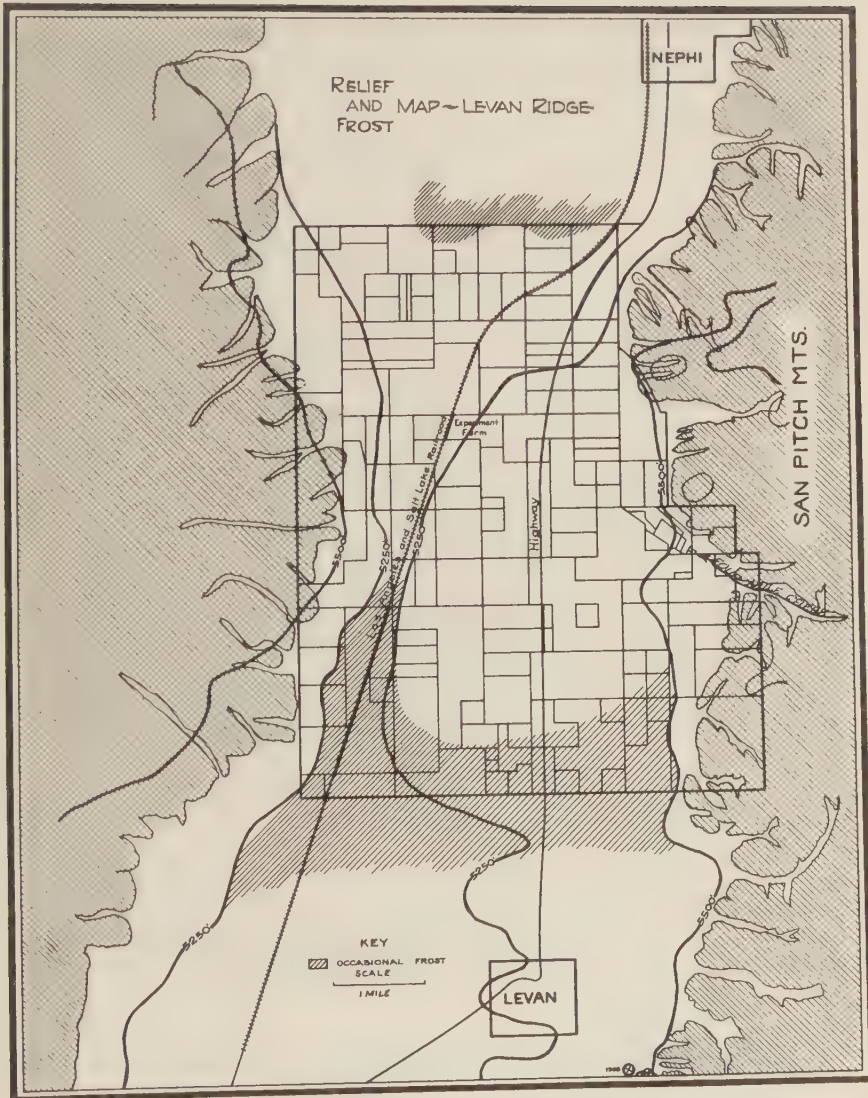


Figure 14

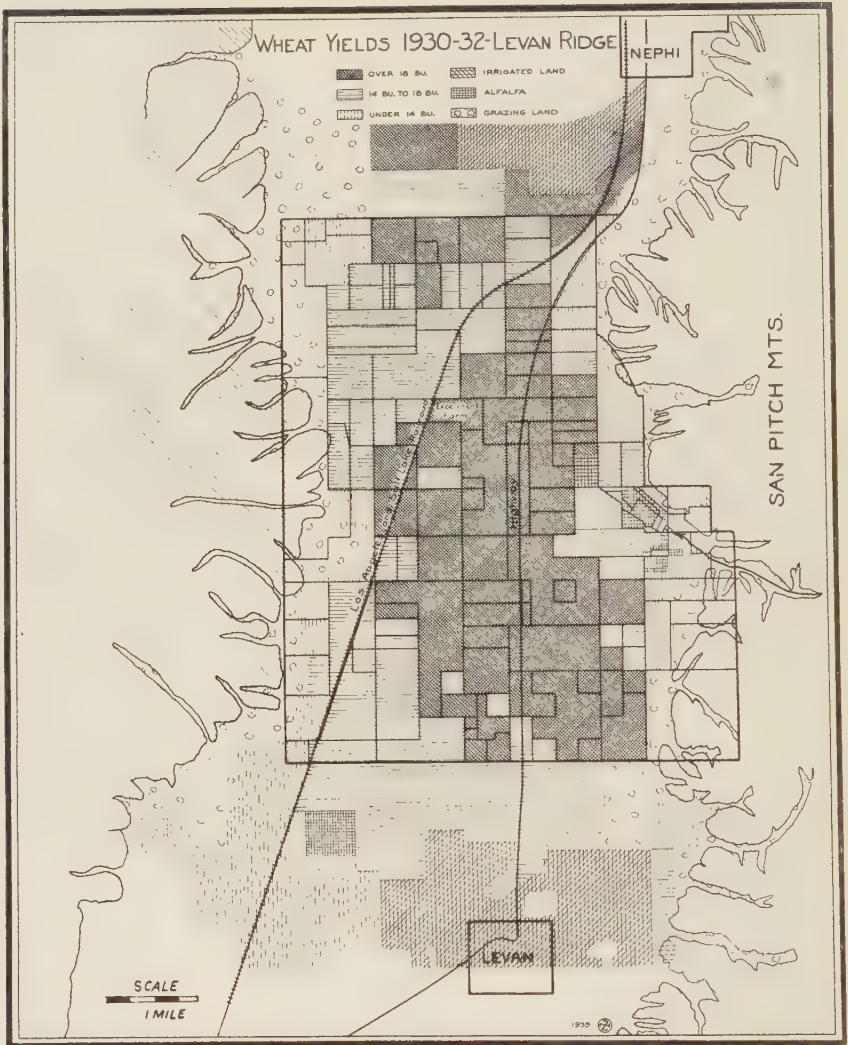


Figure 15

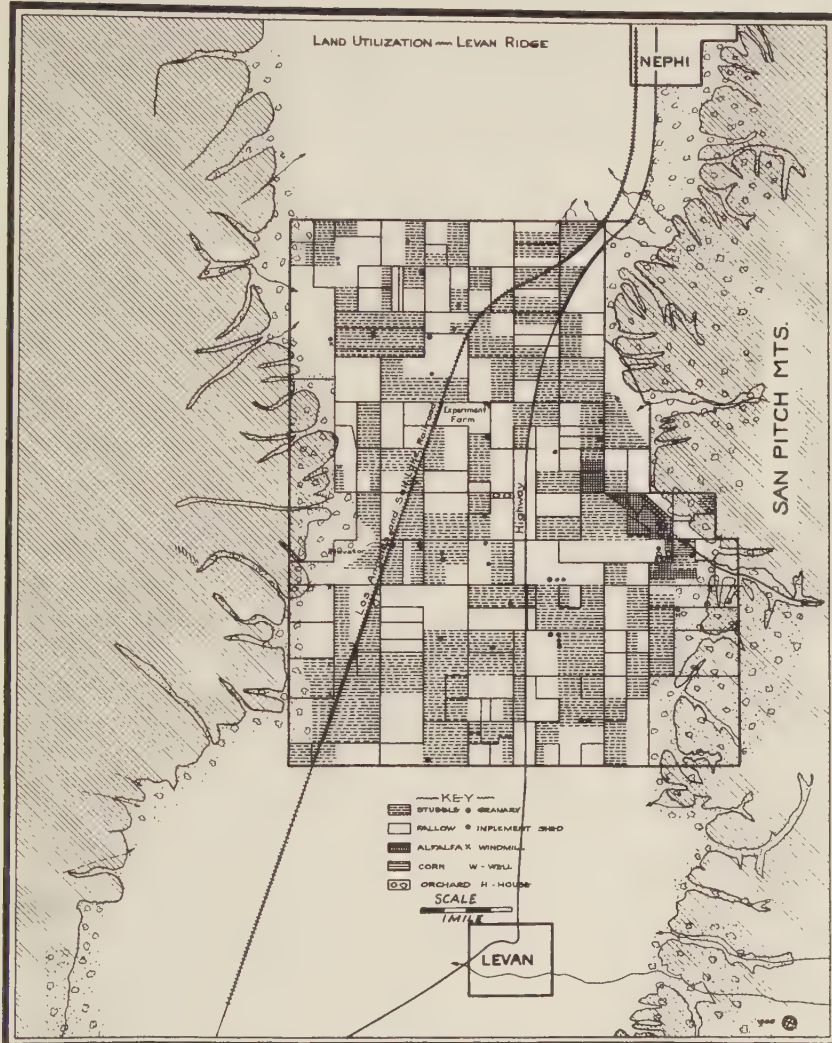


Figure 16

practices. The uniformity in the working habits may be due also in part to the small size and the compactness of the region and to the lack of variations in natural conditions. Soil, relief, altitude, and weather factors remain nearly constant throughout the area. As would be expected these farming operations are those set forth by the experiment workers as the "best practices" to obtain high yields at as low a cost of production as is possible.

Working units.--The amount of land worked as a unit is not always the exact acreage owned by an individual or family. In some families, brothers work the land together, or a son or other relative may operate land in connection with his own. In other cases where the owner does not live in the vicinity or is a woman, the land is leased to an operating farmer. The common procedure is to lease it on shares, the worker usually receiving two-fifths of the crop. In all there are 70 different working units on the Ridge, averaging 232 acres.

About one-third of the working groups manage from 100 to 160 acres, another third work more than 160 acres, and the remainder farm less than 100 acres. Therefore, while the average amount of land owned by an individual or family may be rather small, the actual working units are a size more suited to dry-farming.¹

Variety of wheat planted.--The variety of wheat planted is of vital importance to both yield and opportunity for selling. "Climate dictates in a large measure the variety although market demands also play a role."² Owing to the seasonal distribution of rainfall with a spring maximum, spring wheats for the most part are not adapted to dry-lands. Some soft white winter wheats, however, give very good yields. The ability to sell soft or hard wheat depends on the available supply of each. At Nephi there is

¹O. E. Baker, "A Graphic Summary of American Agriculture," United States Department of Agriculture Yearbook, 1921 (Washington: Government Printing Office, 1922), p. 414: "In the dry-farming areas half sections of land (320 acres) and sections (640 acres) are the normal-sized farms."

²C. L. Alsberg and E. P. Griffing, "Environment, Heredity and Wheat Quality," Wheat Studies, X, No. 6 (Palo Alto: Leland Stanford University, Junior, Food Research Institute), March 1934. Introduction.

a somewhat constant demand for rather large amounts of hard wheat and a varying demand for small amounts of soft wheat.

Amount of land planted each year.--The majority of owners plant approximately half of their land each year (Fig. 16). Where the acreage is small, however, and especially where work on it is part of a larger work program, either because the land is leased or because the farmer owns dry-land not on the Ridge, all the land may be planted one year and all lie fallow the next year. Those farmers who do not own combines hire the work done by owners of combines on the Ridge or operators of combines from Nephi and Levan.

Machinery owned.--Twenty-four tractors and sixteen combines are owned by Ridge operators. In 1932, because of small profits, four of these tractors, the property of men owning 160 acres of land, were not used for plowing. The men owning both tractors and combines also own, or work, more than 200 acres of land.

In an agricultural survey of the county made in 1929 the following statement occurred:

One outstanding feature has been found on the dry-farm of Juab County. The investment in farm machinery is generally excessive. The survey recommends that an investment, not to exceed \$5 per acre, is a satisfactory amount for farm machinery. This will not permit of a man operating 100 acres or less, to own complete equipment for the operation of his farm.

A number of farmers own tractors, but if the farmer has but 200 acres or less, the proportionate time the tractor will be used for plowing the land is too small in comparison with the investment in the tractor; therefore, it is recommended that the farmer owning 200 or less acres should cooperate with farmers holding similar amounts, in purchasing tractors and harvesters.¹

Storage.--Numerous granaries for storing wheat are found on the Ridge, or on the home lots in Nephi. They are made of sheet-iron, circular in shape, some 10 or 12 feet high, and they hold from 2,000 to 3,000 bushels of either loose or sacked grain. These granaries formerly were used more extensively than now, because in 1930 the Farmers National Warehouse was built in Nephi and since that time many of the farmers store there.

In addition to private granaries and the warehouse, much

¹"An Economic Survey of Juab County, 1929," Extension Division, William Peterson, Director, Utah Agricultural College (Logan, Utah: Mimeographed, 1929), Foreword.

grain is stored, at least for short periods of time, in an unbonded elevator on the Ridge, and in the two mills in Nephi. In 1932 about 45 per cent of the farmers stored grain in their own granaries, 21 per cent in the warehouse, 26 per cent in the mill, and 7 per cent either in the mill or warehouse.

Protein content.--An important factor in selling hard winter wheat is the protein content.¹ Dry-farm grains in Utah are characterized by a low moisture content and a high protein content. This content varies from year to year and from one place to another. At times premiums as high as five or six cents for one per cent gain in protein are paid. The top of Levan Ridge sometimes averages only nine or ten per cent, although the lower lands always average more. In 1932 much of the Ridge averaged 14 per cent protein. The basis for payment that year was 13 per cent.

Relation of dry-farming to irrigation.--Farming of dry-lands in Utah is somewhat closely related to farming of irrigated lands.

Irrigated land owned by Ridge land-owners.--In spite of the advantages of owning both types of land, only half of the owners of dry-land on the Ridge also possess irrigated land. Fifty-four of the Ridge farmers own 1,266 acres of land with water rights or an average of 23.4 acres each.

The practicability of farming both types of land was advocated by the United States Bureau of Reclamation. F. H. Newell said:

The best condition for success in the arid regions is one where a small acreage on each farm can be irrigated and intensely cultivated and where a variety of crops, especially those consumed on the farm and in the home can be raised. This small area even if no more than a good-sized garden patch, is the citadel of the home. . . . Outside this area there may be a hundred or several hundred acres under cultivation by arid agriculture without the artificial application of water. This larger tract of dry land may yield a generous living, Here on the dry-lands is where the larger profits may be made with a relatively small investment. It is this combination of irrigated land with larger areas of dry lands on which there is an intelligent application of dry-farming principles which has enabled hundreds of farmers to succeed while their neighbors depending upon one crop and

¹C. L. Alsberg, "Protein Content: A Neglected Factor in Wheat Grades," Wheat Studies, II, No. 4 (February, 1926), 163.

trying to utilize all the dry land every year have failed miserably.¹

The largest number of men owning both types of land are men who own less than 320 acres of dry-land, and most of the irrigated land (85.0 per cent) is owned by these same men. However, the average size of irrigated holdings generally decreases as dry-land possessions become smaller.

Crops raised on the irrigated lands.--The type of crops raised on irrigated land in this section is the result of several factors, chief among them being; (1) the small amount of water available; (2) distance from a truck garden market, (3) proximity to grazing land. These factors have helped to make raising of cattle, sheep, dairy cows and poultry more profitable than truck gardens or orchards and as a result irrigated lands are devoted almost entirely to supplementary forage crops.²

Type of farming employed.--An attempt has been made to classify holdings according to the scale of production carried on.

Basis of classification.--Since no definite agreement on a basis for classifying farmers has been reached by economists, ownership of a definite number of animals or acres has been used as a means of classification, and the following basis has been employed: 2,000 sheep, 50 head of cattle, 20 dairy cows, and 100 acres of dry land. Using such a scale, 49 or nearly half the owners of land on the Ridge were commercial wheat producers.³

¹F. H. Newell, "Irrigation and Dry-Farming," Deseret Farmer, February 11, 1911.

²There are three methods used in the production of beef cattle in Utah; (1) keeping the cattle on farm pastures in summer and feeding them in feed lots during winter; (2) grazing the cattle the year round on the range; (3) grazing the cattle on the open ranges during the summer and feeding them in feed lots in winter. The third method is the one most commonly used in Utah. It is more profitable to use farm lands for the production of crops than for pasturage of beef cattle.

Sheep are generally kept in the mountains in summer and on the deserts in winter, when feeding sometimes is necessary. Like cattle, they utilize by-products and forage crops.

³These units were chosen arbitrarily but they include few, if any, non-commercial producers, although they may not include small-scale commercial farms.

These figures, however, have been approved as suitable for this purpose by members of the Staff of the Utah Agricultural College interested in the raising of poultry, cattle, sheep and dairy cows.

Almost the same proportion holds true in owning irrigated lands. It might be thought that the irrigated land would be owned by the smaller dry-land owners. However, this is not the case. Fifty-six per cent of the commercial producers own 68 per cent of the irrigated land. These proportions show that the irrigated land is not owned by the smaller dry-land owners. This indicates the close relation between the two types of farming.

Other sources of income.--Products other than wheat raised commercially by these farmers are sheep and wool, cattle, eggs and honey. Poultry-raising is the most popular supplementary source of income, five farmers producing eggs on a commercial scale, and many others owning large farm flocks. White leghorns predominate, and for the most part the eggs are sold to the Utah Poultry Association for distribution in New York City. Usually cattle are shipped to Los Angeles, sheep and lambs to Denver or Kansas City, and wool to Boston. In addition to farming, some owners have other work. Those who neither work nor raise supplementary crops are women or elderly people.

Only seven men own no irrigated land but devote all their energies to dry-farming, working their own land, leased land, or doing custom work for others.

Thus but 8.4 per cent of the owners of Ridge land pursue only dry-farming; 35.5 per cent farm the dry-lands as part of a general farm program; 8.4 per cent also operate a stock-raising unit or produce another crop, such as eggs, cream, honey, or hay on a large scale; 26.1 per cent have other work; 6.7 per cent work Ridge land with other land; and 14.9 per cent have no other occupation.

Section 2. The San Juan Dry-Land Area-- a Dry-Farm Region of Many Crops

Differing widely from the Levan Ridge in appearance, soil, altitude, location of homes, farm practices and markets is the largest potential dry-farm region of Utah. It lies in San Juan County in the extreme southeastern part of the state directly east of the town of Monticello, and extends to the Colorado border. This dry-farm area does not end at the state line but continues down the Montezuma Valley in Colorado.

Since 1876, when the first herds were brought to the grassy lands south of Monticello, the rolling and rugged area around the

Abaño Mountains has been a range country. Large ranches were established. Only limited areas near Monticello were farmed, and all of the rest, until the establishment of the Forest Preserves in 1906 and 1907, was public domain.

Significance.--San Juan is the largest county in Utah and yet in 1930 only six other counties had fewer people and its record of but one person for each two square miles was surpassed by none and equalled only by the mountainous county of Daggett, and by Grand County which lies on the eastern desert. San Juan County has only 2.2 per cent of its land in farms. And even this small amount of land cannot be classified as cultivated land because the average of cleared land per farm is very small. Using the classification of the assessor's office for this dry-land region, only about 13 per cent of this land in farms is cultivated.¹ According to the report of the State Tax Commission only 0.7 per cent of the land in the county is assessed as improved farm land.²

With very little irrigated land, much of which is used for alfalfa, most of the crops are produced on the dry-lands.³ According to the 1930 census 96.6 per cent of the county's wheat is raised on the dry-lands and a high percentage of other crops.

Disadvantages.--The sparsity of population, the small amount of land in farms and the still smaller percentage cultivated may be explained in part by the following factors; (1) lack of transportation facilities, (2) remoteness from markets, (3) broken topography, and (4) varying depth of soil.

Transportation facilities.--The chief town of the region is Monticello, which is located 5 miles east of the Abajo Mountains, 93 miles southeast of the main line of the Denver and Rio Grande Western Railroad at Thompsons, Utah, 66 miles from the narrow-gauge branch line of the Rio Grande and Southern Railroad

¹Assessment Roll, 1932, County Assessor's Office, Monticello, Utah.

²State Tax Commission of Utah, Second Biennial Report for the years 1933-1934, 1934.

³Water rights for the Monticello district covering approximately 10,563 acres have been adjudicated on three creeks near Monticello. Certificates for only 4,248 acres, however, are recorded on the State Engineer's Office. Rights prior to 1903, as shown in what is referred to as the Sheeley decree and not included above, are 290 acres. (From records in the State Engineer's Office, Salt Lake City, Utah, August, 1935.)

at Dolores, Colorado, and 107 miles from the same line at Durango, Colorado. The 1930 Census gives the following population figures for the various towns: Blanding, 555; Monticello, 496, Moab, 853; and Thompsons, 93. Blanding lies at the southwest end of the dry-farm region, and Moab, on the road to Thompsons, is 57 miles north of Monticello.

Formerly the freight rate from Monticello to Thompsons was about 85 cents per hundred pounds, but with the improvement of roads and inauguration of regular mail service between the two places, the cost is now less than half that amount. In 1932 wheat was taken from Monticello to Thompsons for 30 cents per hundred pounds. That year the Moab Garage, which holds the mail contract, carried 3,000 pounds daily for six weeks. Although the road between Moab and Monticello is good, a climb of 3,000 feet must be made in the fifty-seven miles.

Lack of markets.--Most of the people of Utah live where the Wasatch Mountains and the steep west front of the Colorado Plateau Series meet the Great Basin. The state seems to have turned its back upon this isolated southeastern portion, separated from the other inhabited areas of Utah by wild, rugged lands or the desert.

Economically and commercially this part of Utah is closely bound to southwestern Colorado. Grand Junction, seventy-eight miles east of Thompsons, is the distributing point for much of the cheaper merchandise used in the region and the market to which cream is shipped by parcel post. At Dove Creek and Cortez in the Montezuma Valley wheat, beans, root crops (especially potatoes), and cattle are disposed of, often through the medium of barter, the Utah farmer exchanging his products for goods from the stores, flour at the mill, or apples from the Colorado farmer. Dolores and Durango on the railroad are the loading points from which cattle and other products may be shipped.

Grist mills, located at Monticello and Blanding, grind flour for home consumption, and ship south to Bluff on the Virgin River and to the Navajo Indian Reservation. There, flour is exchanged with the Indians for pine nuts and Navajo rugs which in turn are sold, frequently making a return on the wheat double what it otherwise would have been. Potatoes also are traded to the Indians or taken as far east as Gallup, New Mexico. Flour from Monticello goes north to Moab and as far east as Dove Creek,

Colorado, thirty-one miles from Monticello. The Monticello mill uses about 20,000 bushels of wheat a year running continuously in the autumn, and then, off and on, as needed.¹

Wheat raised in the San Juan area is used locally for the most part. In addition to the two mills in Utah, flour mills at Dolores and Cortez also buy and grind San Juan wheat. The normal production of the region is 50,000 to 75,000 bushels, although some years the production of the region reaches 100,000 bushels. During the years with bumper crops wheat is shipped by truck to Grand Junction, Colorado, and Price, Utah.

In the Pioneer Fringe, Isaiah Bowman says, "the measure of profit is the cost per bushel not the yield per acre," and "the margin on a marketable product, between production cost and market price, is wide, but the trick is to get the product to market."²

This is exemplified in the San Juan region. Land, labor costs, and taxes are low, but the high cost of transportation has retarded the development of the region.

Physical characteristics.--The San Juan region is a high plateau above which mountains rise and below which streams are sunk.³ While much of the land is nearly level, deep canyons make parts of the region almost inaccessible or reached only by circuitous routes.

The altitude at Monticello is 7,050 feet; that of the dry-farm area ranges from 6,500 to 7,250 feet. West Montezuma Creek and several of its branches rise in the Abajo Mountains. These mountains receive heavy precipitation in winter in the form of snow which furnishes a limited amount of water for irrigation far into the summer. Within the dry-farm region itself are the heads of other branches. These stream beds, beginning modestly as "draws," develop within a short distance into sharply-cut deep canyons in which the streams fluctuate widely and are alternately dry and in flood stage. The deep steep-sided valleys divide the

¹Figures from Mr. Adams, owner of flour mill, Monticello, Utah.

²Bowman, op. cit., pp. 113, 21.

³W. H. Holmes, "Report as Geologist of San Juan Division," Ninth Annual Report of the United States Geological Survey of the Territories, 1875 (Washington: Government Printing Office, 1877).

W. H. Holmes, "Report on the Geology of the Sierra Abajo and West San Miquel Mountains," Tenth Annual Report of the United States Geological Survey of the Territories, 1876 (Washington: Government Printing Office, 1878).

tableland into peninsulas and make road building both difficult and expensive. The heavily-wooded canyons are used only for grazing but, in addition, render a valuable service to the dry-farmer by causing air drainage which lengthens the growing season in the southern part of the area.

Although the altitude of the region is so high, at Monticello the average frost-free period recorded for eleven years was 128 days, and for the five years for which data are available for Northdale, Colorado, it was 123 days.

In general the soils of southeastern Utah are residual and partake of the nature of the parent rock. They result from the weathering of the horizontal strata of shales and sandstones. Since they vary greatly both as to depth and texture, they differ in their suitability to dry-farm practices and in yields of crops. The soil best suited to dry-farming is the darker medium clay loam with a depth of at least six feet.

Advantages.--In spite of distance from railroads and markets, broken topography and varied soils, the region has many assets for dry-farming. Large stretches of the land are nearly level, the soils for the most part are deep and of a quality suitable for dry-farming, and the sage flats are no harder to clear than other dry-farm regions. Furthermore, the average rainfall is higher than that in the other regions and there is a large amount of land available for dry-farming.

Amount of land available.--San Juan has long claimed to have the largest area of dry-farm land in the state. A United States Geological Survey report in 1932 classified 72,000 acres as dry-farming land and 29,000 acres as suitable for forage crops. This latter type embraces land suitable for the production of grain hay in most years, and should be included in the dry-land area. Thus the total given by them is 101,000 acres.¹

The dry-farm region begins seven miles north of Monticello and extends along the road southwest almost to Blanding, twenty-two miles away (Fig. 17). The distance from Monticello straight east to the Colorado border is sixteen miles. The dry-farm lands are contained within a rectangle made up of six townships from north to south and about three from east to west, and include the

¹Deeds and Falck, op. cit., table on last page (unnumbered).

small areas of land dry-farmed near Blanding and La Sal. Within this rectangle, both in the north and in the south, much land is unsuited to farming.

Homesteaded land within this area, roughly estimated, covers 188,720 acres.¹ Of this amount for taxing purposes about 21,500 acres have been classified as dry-land and 92,000 acres as uncultivated land, meaning uncleared dry-land. Thus 48.6 per cent is classified as uncultivated, 11.2 per cent as dry-land, 1.37 per cent as irrigated, and 38.6 per cent as grazing or other land.

Rainfall.--Rainfall at Monticello and the neighboring dry-farm region differs from that in other dry-farming regions of Utah both in amount and distribution. May and June are the driest months while September receives the heaviest rainfall. Although the increased amount of rain is an asset, especially since the evaporation is no greater and probably not so great as in some other regions, losses from run-off during the summer are high, and the smaller amount of rain in May and June is not an advantage in raising wheat. It is possible that the higher rainfall in late summer aids in producing other crops.

Yields--Highest wheat yields in the San Juan region are found immediately south of Monticello, where, because of altitude, proximity to the mountains and location east from the mountains, the rainfall is probably higher.

The lowest yields in the area were those of lands immediately east of Monticello which were formerly a part of the sage flats. The low sage indigenous there suggests that the soil may be shallow, and it is likely that this district suffers from cold winds in spring. Sheep men who use the area for grazing regard it as too cold in spring to be used for lambing.

Clearing the tree-covered land offers even greater difficulty than that presented by the sage lands. Nevertheless farms have been homesteaded in these lands while sage-covered land was still vacant.

Vegetation.--The name, Great Sage Plain, suggests the dominant type of vegetation.² The sage may occur alone, with

¹County Assessment Rolls, 1932, Monticello, San Juan County, Utah.

²Wilford W. Robbins, Native Vegetation and Climate of Col-

clumps of scrub oak scattered through it or in conjunction with pinyon pine (Pinus edulis), and juniper (Juniperus monosperma). Near the canyon edges are found other bushes and western yellow pine (Pinus ponderosa).

The advantage, however, of having timber is a real one. Juniper furnishes durable fence posts and both juniper and pinyon pine may be used for building purposes. In addition to these two kinds of wood, western yellow pine from the canyons and mountains offers a further supply for building purposes.

The abundant supply of fire-wood is also a real asset. The average San Juan farmer would find it almost impossible to pay for coal which must be hauled in from the mines near Thompsons. Poorly-built houses and low temperatures (at Northdale, Colorado, the thermometer registered -42° F. in February, 1933) make heating difficult and a large supply of wood necessary. San Juan County in 1929 cut more fire-wood than any other county in Utah.

Sources of water.--Finding water for culinary and stock purposes is one of the greatest difficulties encountered on the dry-farms of Utah. There are no perennial streams, and springs are scarce. Therefore, most of the water used for culinary purposes is obtained from shallow wells. Three wells reach 100 feet in depth, but most of the wells are less than 50 feet and some are as shallow as 10 feet. Only three or four have windmills for pumping and fewer have engines. Although two-thirds of the people have wells or springs on their lands, frequently this source of water is not near the house. Wells are located in low spots, sometimes in the beds of intermittent streams. Thus, most of these people carry their water for some distance, even when it is obtained on their own land; others haul water two or three miles from a neighboring farm. Most of the farmers secure water for cattle by saving the run-off or seep water in small shallow, dirt reservoirs.

This situation has been improved in recent years. During the drought year of 1934 some of the relief money granted the state was spent to sink deep wells in this part of San Juan County.

Adjustments.--San Juan County possesses many unusual features and, therefore, adjustments here differ from those found else-

orado in their Relation to Agriculture, Experiment Station, Fort Collins, Colorado, Bulletin No. 224, 1917, p. 40.

where in the state. Long distance from railroads and markets has made it difficult to find a profitable commercial crop. From varying environments settlers brought in new crops. Broken topography has helped to isolate farmers and make for lack of uniformity. Variations in soil and differences in length of growing season have increased the need for a variety of crops.

Many of the settlers are not of the Mormon faith so that the usual "Mormon" village is not found. Farmers live on their lands, the occurrence of small quantities of water at intervals making this possible. Yet over a vast area no large amount of water is found, as is evidenced by the lack of towns.

Pattern of holdings.--Although many factors found here tend to make for variety, yet there is much uniformity throughout the region. Most of the land was obtained by homesteading after the passage of the Smoot Act. Thus the original homestead contained 320 acres and but few have added other land to this. With only a small part of the homesteaded land cleared, there has been no incentive to buy other land. Very few of the dry-farmers own less than half a section. For homesteading, the land is selected by quarter sections, making the boundaries straight lines. Most of the holdings differ little in size or shape.

Roads.--To reach the dry-farms, good dirt roads connect with the highway running north and east and with the state road which runs between Monticello and Blanding. For the most part these dirt roads follow section or half-section lines, although in some cases short cuts across fields have been utilized.

Homes.--Because of a limited supply of irrigation water the area of irrigated land near Monticello is small, and almost immediately upon leaving the town, whether going east, north, or south, the land appears to be almost entirely uncultivated and in its native state. However, the roads are bordered on both sides with barbed wire fences kept in good condition and a few houses and fields are seen.

These houses are of two types, log or unfinished lumber. Those of the earlier settlers were built of lumber cut on the mountains and sawed at one of the three or four mills at the base of the mountains. Only a few of these were painted. The majority of the houses are made of logs, usually yellow pine, which have been rudely squared. The more recently built dwellings are

of pinyon pine logs standing upright instead of lying horizontally. In this way the trees cleared from the land are utilized. Many of the roofs are of sod, some of the windows have gunny sacking or canvas in place of glass, and a few of the new houses have dirt floors. Cracks between boards and logs are common and make heating in winter difficult although the rooms are small. Walls within are usually unfinished or papered with newspapers. Furniture is scanty and often home-made. Every farm has a storm cellar known locally as a "cave," where vegetables and fruit are stored. This is a real pioneer region.

Land values.--Not only is the pattern of land ownership alike, but the value of dry-farm land throughout the region does not greatly vary. The assessed value is \$5.00 an acre. Only about 500 acres of uncultivated land are valued at less than this amount, and some 400 acres, having small quantities of water, at varying amounts between \$5.00 and \$10.00.

Surrendered lands.--In this dry-farming section 16 per cent of the dry-lands east of Monticello is no longer in private ownership. The Federal Land Bank of Berkeley owned some 10,840 acres in 1932. Some of this acreage consisted of land surrendered by veterans but loans had also been made to others who have not repaid them. In addition, some land is held in receivership by the state, county, and private banks, which own respectively, 23, 20, and 21 per cent of the 31,070 acres of the relinquished land.

Irrigated land.--Only eleven dry-farmers owned irrigated land in 1932. The total of 558 acres of irrigated land averaged 50 acres per farmer.

Farm practices.--A wide variation in farm practices is found in the San Juan region. This is not due to great differences in natural factors but is due partly to individual initiative and partly to the fact that little money is available and each farmer does the best he can with the knowledge and equipment at hand. Although the experiment station is in their midst, its influence has not been greatly felt. This is explained by the facts that the station has been established only since 1925, and that it lies at a distance far enough from most of the farmers to make it inaccessible except by automobile and few farmers own cars.

In 1932, a large percentage (82.9) of the farmers were engaged in subsistence farming.¹ This is largely the result of

¹Data from field work in the region, fall 1932.

distance from markets and shipping points and a lack of exportable goods that can stand high transportation rates. It is also partly due to the fact that settlers came in to homestead land with no capital to buy either machinery or livestock. Several came without money even for seed, which at times has been supplied by neighbors.

The farm must, first of all, supply the needs of the family, so far as possible. Food is obtained by raising wheat, vegetables, livestock and poultry. If wheat is not raised, the farmer may work for others who pay him in wheat. Vegetables such as potatoes, carrots, beets, turnips, beans, squash, and pumpkins are produced in abundance, and are frequently exchanged for other food necessities. Livestock products are found, but not in all homes. Sometimes all the cream is saved for shipping and the family may seldom have butter or meat. Chickens are killed in the fall and the meat canned to avoid winter feeding. There is always, however, a plentiful supply of potatoes and beans. The money received for milk and eggs or for the occasional sale of an animal furnishes most of the cash income. The farm furnishes fuel and fence posts. Clothing, then, is the one great need, and in 1932 the Red Cross, to a large extent, was filling this need.

The farm must also furnish feed for the livestock and poultry. Uncultivated lands are used for grazing, and vacant land, unused homesteads, and school sections are rented for this purpose. Feed stuffs are produced in the form of cereals (corn, barley, oats, and rye), root crops (mangels, sugar beets, carrots) and forage crops (brome grass, sorghum, and millet). Few cows of a pure dairy type are owned, but their place is taken by dual purpose cows, usually roan Durhams. Thus the farmer may derive a weekly income from cream sales and later sell the cows for beef. These subsistence farmers are, for the most part, the more recent arrivals and are located usually in the outlying sections in the east.

The cash product on commercial farms may be wheat, beans, potatoes, livestock or a livestock product. Production of beans and potatoes varies with prices. The prices in 1932 did not offer much incentive for planting either crop. More than one of these crops may be raised on a farm and the cash crop may vary from year to year.

Again using 100 acres as a basis for the commercial pro-

duction of wheat, there were but twenty commercial producers in 1932, four of whom farmed between 240 and 300 acres. Only two dry-farmers owned at least 50 cattle, five had 20 dairy or dual purpose cows, one had 1,250 chickens, and one a thousand turkeys. The San Juan dry-farm region is not a commercial area.

Crops.--In such a farm economy, a variety of crops results. These are shown in Figure 18.

Crops	Acres (Census 1929)	Percentage of Har- vested Land (Census Land)	Percentage of Dry-Farm Acreage 1932	Percentage of State Acreage (Census 1929)
Hay.....	7,587	30.60	.....	44.98
Wheat.....	3,480	14.00	38.10	17.76
Corn.....	1,756	7.10	11.10	0.96
Oats.....	1,372	5.50	9.30	3.04
Barley.....	704	2.80	0.06	2.55
Beans.....	464	1.90	2.10	.....
Potatoes.....	117	0.47	2.50	0.72
Cane and millet..	76	0.03	1.80	.....
Rye.....	76	0.03	6.60	0.20
Alfalfa seed.....	18	.....	.....	.....
Orchards.....	11	.....	.....	.....
Other crops.....	1,607	5.80	12.20	9.24
Fallow.....	7,760	31.30	16.10	19.26
Total.....	24,828	99.50	99.86	100.00

Fig. 18.--Acreage of crops in San Juan County and State

San Juan County leads the state in corn acreage. The 1932 corn acreage reported on the dry-farms east of Monticello was 70 per cent of the entire corn area of the county. The period free from frost does not vary greatly from that in northern Utah, so that a crop is not always assured. Over the southern part of the San Juan region the frost-free period is about the same as at Levan. If the crop does not ripen, however, it can be used for silage, and a considerable portion of the corn planted is raised for this purpose. About three-fourths of the corn is harvested and the rest is cut for fodder or hogged off.

In 1929 the county also led the state in the production of navy beans with one-fourth the entire acreage, all of which was confined to the dry-lands. The local importance of beans is

shown by the fact that they are called "mortgage lifters." Potatoes do well on the dry-lands and are of exceptionally good quality but usually cannot be marketed. So far, wheat has been the best commercial crop.

Wheat is produced in quantity by approximately only one-eighth of the farmers. The average yields for the three years 1930-1932 ranged from 11 bushels per acre on the sage flats to 22 bushels per acre on land formerly covered with oak brush near the Abajo Mountains. The county average for the three years was 18.2 bushels.

It has been found just as profitable to raise an inter-tilled crop in San Juan County as to leave the land fallow, and this procedure is the one most commonly followed, partly because cleared land is scarce, and partly because other crops, although giving but a low yield, are necessary. The most common crop for this procedure is corn, but potatoes or beans are produced according to the demand for them.

With small acreages, little machinery is owned. In 1932 there were twelve tractors, five combines, and four trucks belonging to farmers in the Monticello region. Much of the harvesting work east of Monticello is done by two different outfits from Colorado. Inexpensive tools and improvised implements are used.

The isolated farmers of San Juan County have few means of supplementing their income. Almost the only way to do this is to help a neighboring farmer at time of planting or harvesting.

On an average, only one-fourth of the land on the occupied farms is cleared and even less farmed. Rather than clear more land on their own farms, these farmers frequently lease cleared land on a homestead where the owner is away. Contrary to the custom at Nephi, this is usually paid for in cash, a definite amount being stated for the use of the land. Twenty farmers lease nearly 1,600 acres of cleared land, an average of 66 acres each. This leased land is usually planted in wheat or other grains.

The San Juan area is still struggling to evolve a permanent agriculture, and is searching for a cash crop which not only is easily shipped but also can bear the added cost of high freight charges.¹

¹Articles on the history of San Juan County have appeared in a local newspaper of Blanding, Utah, also in the Deseret Evening News, Salt Lake City, Utah.

Section 3. A Comparison of the Two Regions

Without knowledge of their income and classifying them only by the amount of land or the number of cattle or livestock they own, most of the farmers who own land in the two regions would probably operate one of the following types of farms--general, cash-grain, crop-specialty, stock-ranch, poultry, or self-sufficing farm. The percentage of each type of farm which was found in these two counties when other types of farms are excluded is shown in Figure 19.

Types of Farms	Percentage	
	Juab	San Juan
General.....	18.0	8.3
Cash-grain.....	32.0	8.1
Crop-specialty.....	4.8	9.0
Stock-ranch.....	7.2	34.1
Poultry.....	3.8	1.1
Self-sufficing.....	2.8	3.3
Other.....	31.0	36.0
Total.....	99.6	99.9

Fig. 19.--Types of farms owned by dry-farmers in Juab and San Juan counties (Data from Fifteenth Census of the United States, 1930).

A comparison of these figures shows the great importance of cash-grain crops in Juab County and of stock-raising in San Juan. Using figures from the assessment rolls, only one-fifth of the farmers in San Juan produced any crop on a commercial scale, while in Juab County 80 per cent are commercial producers or have an income from other sources.

Thus the Levan Ridge and the dry-farm section of San Juan County differ radically. Beginning with structure, this variation continues in the altitude, topography, soils, distribution and amount of rainfall, vegetation, size of dry-farm area, and compactness of farmed lands. The manner of procuring the land in the two regions, farming practices, crops, kind of granary, location of the homes of owners and availability of other sources of income

all differ. But the most important difference is that of accessibility. Ease in shipping wheat and the proximity of markets in the one case has greatly aided the development of the region so that it has become a cash-grain dry-farm area with many farmers operating on a commercial scale. On the other hand, the second region lies far from markets and a railroad, and has remained a pioneer region with subsistence farming largely predominating.

PART IV

COMPARISON OF DRY-FARM REGIONS IN UTAH

The term "dry-farming" brings to the minds of many people the practices employed on the Great Plains in the central part of the United States. Farming without irrigation in the Great Basin, however, is quite unlike that on the Plains. It is partly because natural factors in the two regions differ greatly, that the dry-farming practices are dissimilar. This variance in natural conditions is found especially in the distribution of rainfall, the duration and velocity of wind, and the type of soil.

The Great Plains receive two-thirds of their moisture during the six warm months, while western Utah receives about the same amount from December to May inclusive. Coming during the cool season when inhibiting factors are least active, more rainfall can be conserved in the Great Basin than on the Plains. In the Great Basin as high as 45 per cent of the rainfall of the fallow year has been saved, while on the Plains the amount does not exceed 33 per cent.

The rotation scheme of wheat-fallow is suitable on the Plains, but, because of summer rain and soil blowing, wheat is generally followed by an intertilled crop, usually corn. The disadvantage of steady and frequently strong winds on the Plains has been met by listing and by using a disk plow which barely turns the stubble over, leaving it near the surface where it holds the soil.¹

Dry-farming in San Juan and Washington counties more closely resembles the type of farming on the Plains than that in any

¹Bracken and Stewart, A Quarter Century of Dry-Farm Experiments, Bulletin No. 222, p. 9.

other Utah sections. In these counties an intertilled crop frequently replaces the fallow period, plowing is not so deep as in other sections, less seed is used, and not so much difficulty is experienced in getting the wheat up in the fall. These differences are due, in part, to the lighter soil and greater amount of summer rainfall in these two counties.

While Utah dry-farm regions in general resemble one another, they do present many differences which are the result of differing natural conditions or divergences in human utilization.

Location of lands dry-farmed.--The dry-lands in Utah are found in varying locations. Some are high lands in irrigated regions which lie above the water supply, some are low lands for which the water supply is not adequate. Examples of these two types are found in the lands above the irrigation canals in Rich County west of Bear Lake and in the low lands near Nephi for which water is not available. Only a small acreage of dry-land, however, lies within irrigated districts.

Most of the dry-lands are found in districts for which no irrigation water is available. Some of these dry-land areas are level floors of wide valleys such as Blue Creek, Hansel, and Juab valleys. Others are flat-topped plateaus like those in Rich and San Juan counties, or gently rolling hilltops like the Petersboro and Fairview lands, or wide lake terraces such as those found near Collinston and Logan, or isolated patches of flat ground in narrow valleys like those in the valley leading from Tremonton to Snowville, or the higher fields in Morgan and Summit counties. The type of land upon which the region or farm is located helps to decide the size and shape of the fields.

Location relative to irrigated farms.--Dry-farms sometimes immediately join irrigated farm land, and the farmer of one may operate the other type of land, as at Herriman in Salt Lake County or Mendon, Newton, and Trenton in Cache County. Some dry-lands lie at a short distance from towns as those on the Levan Ridge or the west side of Salt Lake Valley. Others are located a considerable distance from irrigated fields as is the case in Blue Creek and Hansel valleys in Box Elder County. They may even not be connected with irrigated farm-lands at all, of which the San Juan region is a good example.

Permanent homes are found on dry-farms where water is available for domestic use and for stock. Since many regions have

no water there are no permanent homes in them. Such sections are farmed by men living in neighboring irrigated sections who haul water to the dry-lands during the busy seasons. These farmers travel to their farms each day, or temporarily remain upon them during the busiest season.

When the two types of farming districts are contiguous, or are only ten or fifteen miles apart, the farmer has no difficulty in working both farms, although he may temporarily stay on the dry-farm during the busy season. When the dry-lands lie at a greater distance the farmer must live upon them, at least for the summer season. In such cases he usually spends the balance of the year in an irrigated area but does not necessarily farm land under irrigation.

In dry-farm regions, water is obtained from wells or springs, or is hauled into the regions. The shallowest wells, from 10 to 50 feet deep, are in San Juan County; the deepest are probably those in Box Elder County which reach a depth of 300 or 400 feet. Springs are found in parts of Washington, Cache, and San Juan counties. In most of the other dry-farm sections water is taken into the region, and in all of them it is carried from place to place.

Living conditions on the farms.--In the dry-farm regions in Utah, living conditions depend largely upon the presence and abundance of water, and upon proximity to an irrigated district (Fig. 20).

Tenancy.--In 1930 tenants operated 42.4 per cent of the farms of the United States; in Utah, they operated only 12.2 per cent.¹ Webb says,

Tenants cannot live in the arid region. They depend on crops and crops are uncertain. . . . The tenant has no reserve financially, and only people with reserve resources can remain in an arid region in time of drought.²

Although there is little actual tenancy on the dry-farms of Utah, it is a common practice, particularly in the northern and central parts of the state, to lease land.

Except in San Juan and western Box Elder counties, a large percentage of the farmers carry on dry-farming in conjunction with irrigated farming. Only in these two sections, which

¹"Agriculture," Fifteenth Census of the United States, Second Series.

²Webb, op. cit., p. 514.

are situated far from irrigated districts, has the land been developed by men who work no irrigated land. Blue Creek and Hansel Valley lie some fifty miles from Cache Valley, the original home of most of the dry-farmers of western Box Elder County.

Regions	County	Homes			Water		Close to Irrigated District
		Permanent	Temporary	None	Springs	Wells	
Petersboro.....	Cache.....	✓			✓	✓	✓
San Juan.....	San Juan....	✓			✓	✓	
Howell.....	Box Elder...	✓				✓	✓
Hansel Valley..	Box Elder...	✓				✓	
Blue Creek.....	Box Elder...	✓	✓			✓	
White's Valley.	Box Elder...		✓			✓	
Kolob Plateau..	Washington..		✓		✓		
Great Plains...	Washington..		✓		✓		
Salt Lake.....	Salt Lake...		✓	✓		✓	✓
Clarkston.....	Cache.....	✓		✓		✓	✓
Trenton.....	Cache.....			✓			✓
Newton.....	Cache.....			✓			✓
Mendon.....	Cache.....			✓			✓
Nephi.....	Juab.....			✓			✓
Fairview.....	Sanpete.....			✓			✓
Tooele.....	Tooele.....			✓			✓

Fig. 20.--Living Conditions

Blue Creek and Hansel Valley farms are strictly commercial wheat farms. Most of them are owned by men who live at too great a distance to operate successfully both a dry farm and an irrigated unit. Because the distance from the farmers' homes is so great in order to be profitable, large-scale production is necessary.

In San Juan County most of the farmers live upon the dry-farms, and, since there is almost no irrigated land in or near the dry-farm area, only a few of them own irrigated land.

Size of holdings.--Dry-farm units in Utah generally do not

reach the proportions which are found in some other dry-land areas of the United States. In Whitman County, Washington, the average size of wheat farms is 496 acres.¹ Although the average amount of land cropped by each farmer in western Box Elder County is over 400 acres, for the most part the Utah average of dry-land individually owned is much lower (Fig. 21).

The smallness of dry-land units in Utah is probably due to the following factors: (1) small size of the areas adapted to dry-farming, (2) class of people in Utah who are interested in dry-farming, (3) manner of acquiring the land, (4) division of lands through inheritance. Figure 21 shows a rough estimate of dry-farm land in the large dry-farm regions.

Dry-farm holdings vary greatly in size in different parts of the state, ranging from one acre to 2,000. Largest average-sized farms are found in Blue Creek and Hansel valleys in Box Elder County, where the average size is 633 and 983 acres respectively. Few farms in either region contain less than 100 acres. These large acreages are the result of the manner of acquiring the lands, their recent utilization for dry-farming, and their distance from both irrigated sections and the homes of the owners.

The smallest dry-farm holdings are those in Mendon, Cache County. This is probably due to the fact that some of the small acreages were formerly irrigated, but since there is no water for them at present they are classified as dry-land. Many of these will receive water again upon the completion of the Hyrum Dam on the Little Bear River, when about 1,000 acres of land now classed as dry-land will be put under the ditch. The average size of Mendon dry-farms will doubtless then be larger. Another factor operating here, as elsewhere, is the division of farms upon the death of owners.

Other small holdings contain land with unsuitable soil or uneven topography. This is illustrated on the Levan Ridge and in upper Blue Creek Valley.

Land values.--With wheat yields lower than those in well-watered regions or on irrigated lands, and with only one-half of the land in crop each year, dry-farming can be carried on only

¹J. S. Davis, "Pacific Northwest Wheat Problems and the Export Subsidy," Wheat Studies, X, No. 10, August, 1934, p. 370.

Acres	Hansel Valley		Blue Creek		Howell		Levan Ridge		Clarkston		San Juan		Mendon	
	Per- sons	Acres	Per- sons	Acres	Per- sons	Acres	Per- sons	Acres	Per- sons	Acres	Per- sons	Acres	Per- sons	Acres
Over 999.....	10.0	28.1	6.3	21.8	2.5	10.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
500-999.....	25.0	37.5	24.0	37.8	10.0	27.5	2.7	12.0	0.7	4.8	0.0	0.0	0.0	0.0
330-499.....	15.0	12.8	20.3	20.9	15.0	22.2	5.6	15.2	2.0	8.2	0.0	0.0	2.5	15.3
260-329.....	10.0	6.9	11.4	8.6	2.5	3.0	5.6	11.5	4.8	13.0	1.6	6.8	0.0	0.0
175-259.....	20.0	10.1	7.5	4.0	20.0	19.9	10.1	16.2	6.1	14.5	2.4	7.6	3.3	11.2
100-174.....	15.0	4.1	15.2	4.9	17.5	10.0	20.1	22.1	19.1	29.8	17.3	32.3	14.2	30.5
50- 99.....	0.0	0.0	8.9	1.7	20.0	5.7	29.3	16.4	22.4	19.2	30.7	27.6	16.6	19.6
20- 50.....	5.0	0.4	0.0	0.0	5.0	0.6	22.9	6.1	20.4	7.8	44.9	25.3	33.3	18.0
Under 20	0.0	0.0	6.3	0.2	2.5	0.1	3.6	0.4	24.5	2.4	3.1	0.4	30.0	5.1
No. of persons	20		79		40		109		147		127		120	
Ave. no. acres dry-land.....	436		410		265		123		89		69		60	
Ave. of total acres owned..	983		633		603		241		139		386		85	

Fig. 21.--Percentage of owners and acres of dry-farm land in seven regions.
Data from Assessment rolls for the various counties.

where land is cheap.¹ Dry-farm lands in Utah occupy a position midway in value between irrigated and grazing lands. The value of dry-lands is generally commensurate to the value of irrigated lands found in the same counties.

Assessed values for dry-farm land in Utah vary from an average of \$5.07 in San Juan County to \$23.87 in Weber County.² These average values for counties are shown in Figure 23. For the most part they are a reflection of the degree to which a region can produce wheat and of the cost of shipping it to a market. Presence of water for culinary and stock use and proximity to an irrigated section are also factors in establishing values.

The average amount of wheat which an acre can produce is an important factor in determining the value of the land. The highest priced dry-farm lands are in Weber, Cache, and Morgan Counties. Due to their location in the northern part of the state, and to the presence of mountains and higher altitudes, the rainfall in these counties is heavier and more effective, and therefore yields are higher than in other Utah counties.

Medium-priced dry-lands occur in Summit, Salt Lake, Utah, Juab, Box Elder, and Sanpete counties, which have medium yields. The relatively high yield for western Box Elder County would seem to make land values higher in that county, but its remoteness from an irrigated region probably accounts for its lower land values. No reason is apparent for the relatively low value of dry-lands in Salt Lake County.

Low-assessed values for dry-farm lands are found where yields are low, as in Rich, Sevier, Washington, and Millard counties, and in parts of Tooele County. These low yields are the result of the lack of effective rainfall, of high temperatures and evaporation, of poor soil conditions and short-growing season.

Distance from a railroad or market is an especially important factor in the valuation of land in San Juan County, which has a high average rainfall and yield (Fig. 34). Distant markets or railroads may help to account for the low values in Washington

¹The average yield per acre of dry-farm wheat in Utah for 1929 was 15.1 bushels and for the years 1930-1932 was 20 bushels. The figures for 1929 are from the Fifteenth Census of the United States, and for the years 1930-1932 from figures computed by the State Statistician from reports to Wheat Allotment Committees.

²State Tax Commission of Utah, Second Biennial Report for the years 1933-34, 1934, p. 59.

County. Other dry-farm regions do not suffer because of this factor. Due to climatic handicaps in some of the dry-farming sections in Tooele County, the presence of a railroad has not proved effective in increasing land values.

If the dry-farming sections are near an irrigated region, the land values are often higher. In manufacturing districts land values are usually relatively high and values for dry-farm lands would likewise be high (Fig. 26).

Within the regions only a few factors, such as type of soil, length of growing season, and topography, operate to differentiate the value of the land (Fig. 22). The factor of most importance in affecting land values within a region is soil, as is seen in the detailed study of Levan Ridge.

Two other factors are frost and uneven topography. The adverse effect of frost is seen on Levan Ridge, and that of uneven topography in Cache Valley, where foothill lands are of low value.

Value per Acre	Clarkston	Levan Ridge	Blue Creek	San Juan
\$ 0- 5.....	.....	.....	11.6	97.4
6-10.....	.....	9.7	53.8	1.6
11-15.....	21.87	19.14	34.1	.....
16-20.....	21.11	68.2	.....	0.5
21-25.....	19.39	.....	.....	0.4
26-30.....	8.34	.....	.....	.....
31-35.....	8.53	2.7	.....	.....
36-40.....	16.41	.....	.....	.....
41-45.....	3.70	.....	.....	.....
46-50.....	0.54	.....	.....	.....
51-55.....	.....	.....	.....	.....
56-60.....	0.01	.....	.....	.....
Average value for the region	\$28.37	\$16.86	\$11.10	\$ 5.17
Assessed value for county in which region occurs.....	Cache County \$22.14	Juab County \$11.62	Box Elder County \$11.61	San Juan County \$ 5.07

Fig. 22.--Land values within the dry-farm regions* (in percentages). Data from Assessment Rolls for the various counties.

*This table shows the three types of regions according to the value of dry-farm land. Clarkston lands are of high value; Levan Ridge and Blue Creek of medium value; and those in San Juan are low in value.

Pattern of holdings.--There are two patterns which show plainly in maps of holdings in dry-land regions: (1) compact, rectangular holdings, (2) scattered holdings.

Compact rectangular farms are found in all of the dry-land regions (Figs. 27-32). These are, to a large extent, the result of the rectangular system of surveys used by the government and prescribed by the Homestead Laws. The San Juan area reflects most plainly the effect of these laws, because a large part of the land dry-farmed in San Juan County has been procured by homesteading (Fig. 30).

In only one district in the state do holdings vary to any extent from the rectangular shape and plots made up of multiples of 40 acres. This is in Cache Valley where fields are not a quarter section or half that amount in size, but are odd-sized, such as 62, 26, 153, or 285 acres. This condition is not common on the dry-lands where lands are usually owned by halves or quarters of quarter-sections. This difference may be traced partly to the fact that lands were procured here before the establishment of the national survey (Fig. 27).

A comparison of Figures 28 and 29, and of Figures 31 and 32 shows the smaller size of the land units owned and worked on the Levan Ridge, where about twice as many men work an area three-fourths the size of the Blue Creek area represented in the map.

Scattered holdings are typical of Utah farm lands and are found in both irrigated and dry-land regions, with the exception of those in San Juan County where farmers have but few separated fields. The condition is most pronounced in Cache County and is due to the manner in which the land was procured, and to the fact that part of it was formerly classified as irrigated and grazing land (Fig. 33). When the settlements were made, both grazing and irrigated land were allotted to each settler.¹

Yields.--Some relationship between rainfall, temperature and yields can be seen, but it is not so great as it would be if climatic data were available for the exact area farmed. Yields in Cache, San Juan, and Salt Lake Counties are probably higher because of heavier rainfall. Rich County has both high latitude and high altitude (6,000 feet) which results in a short season. Tooele, Millard, and Washington counties have high evaporation,

¹Stewart, "Land Ownership and Utilization."

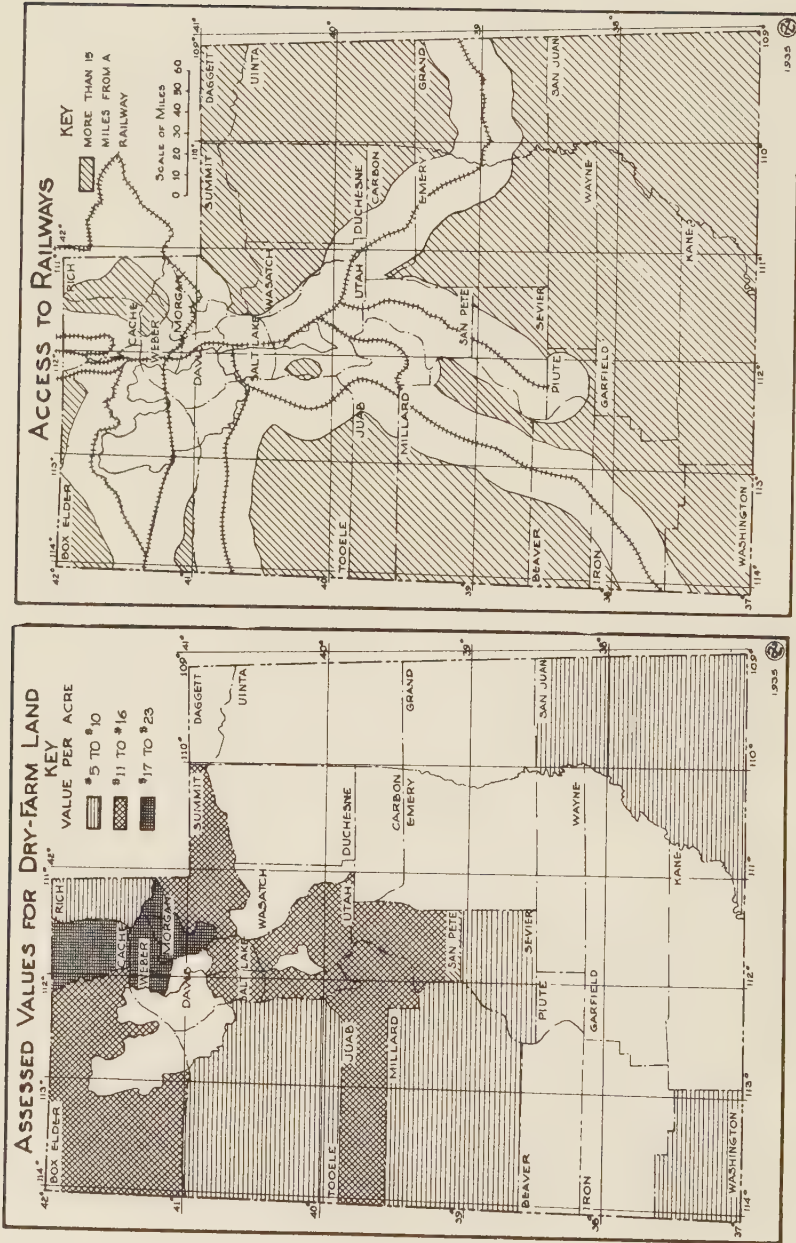


Figure 24

Figure 25

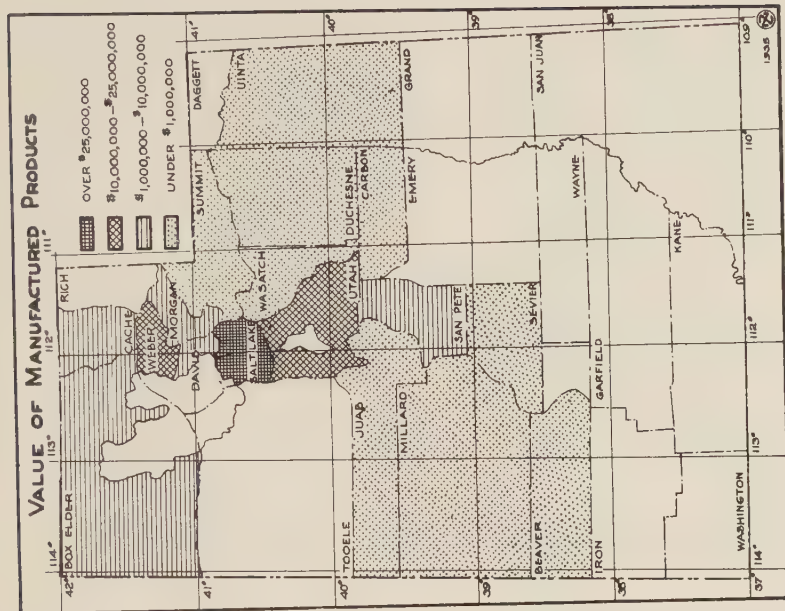


Figure 26

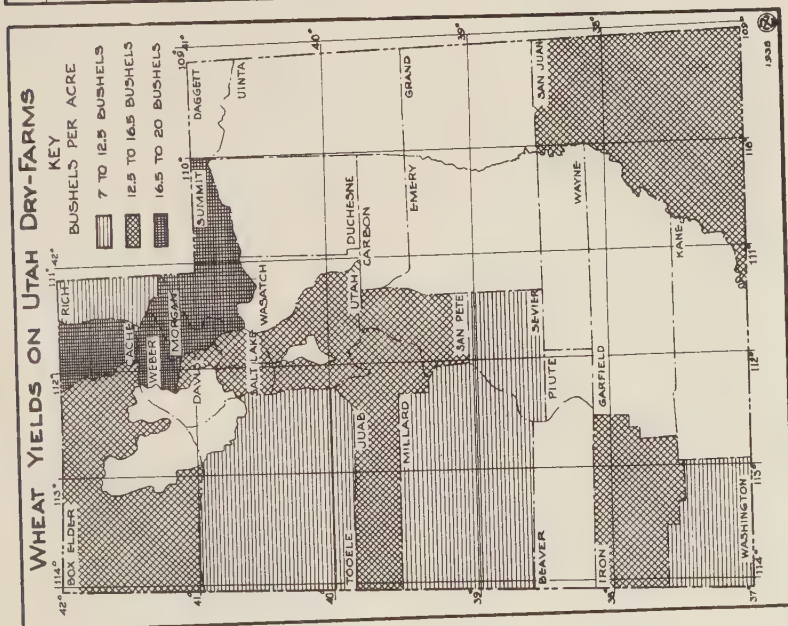


Figure 25

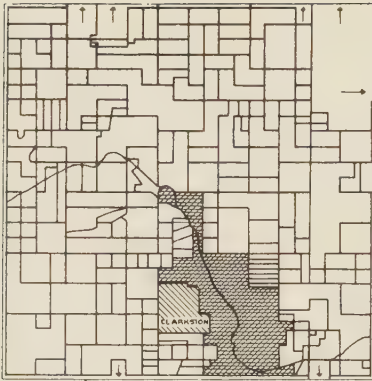


Fig. 27 LAND HOLDINGS
CLARKSTON-CACHE COUNTY

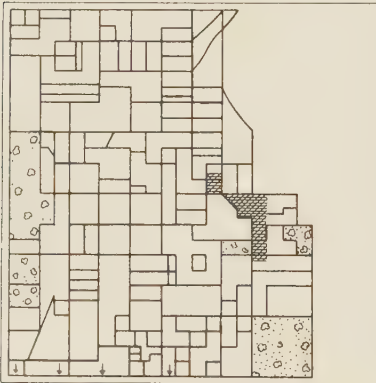


Fig. 28 LAND HOLDINGS
LEVAN RIDGE-JUAB COUNTY

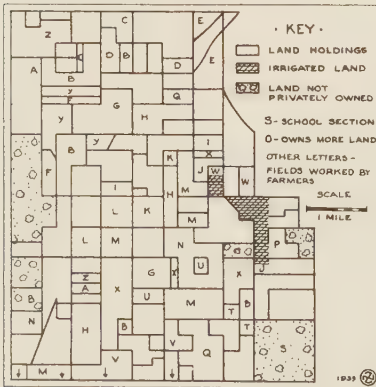


Fig. 29 WORKING UNITS
LEVAN RIDGE-JUAB COUNTY

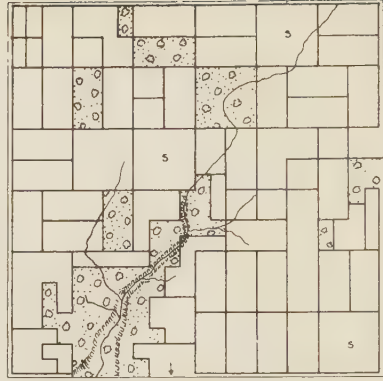


Fig. 30 LAND HOLDINGS
SAN JUAN COUNTY

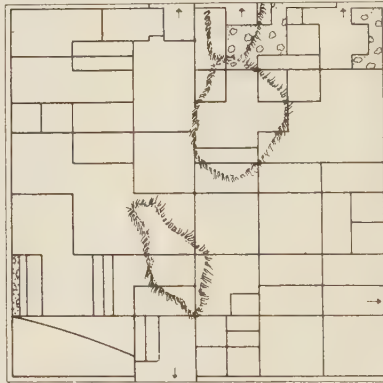


Fig. 31 LAND HOLDINGS
BLUE CREEK-BOX ELDER COUNTY

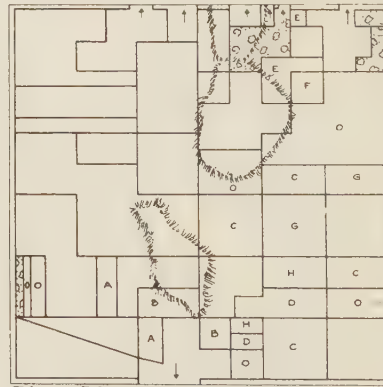


Fig. 32 WORKING UNITS
BLUE CREEK-BOX ELDER COUNTY

which is reflected in low yields (Fig. 34).

Acres	Clarkston			Trenton			Mendon		
	Number of Owners	Number of Fields		Number of Owners	Number of Fields		Number of Owners	Number of Fields	
		Dry Land	All Land		Dry Land	All Land		Dry Land	All Land
Over 999....	...	...	...	...	...	...	...	...	...
500-999.....	1	4	4	3	10	10	...	...	...
330-499.....	3	10	11	1	3	4	3	23	23
260-329.....	7	23	28	2	8	12	...	...	...
175-259.....	9	18	27	1	2	2	4	19	19
100-174.....	28	75	113	8	17	20	17	40	45
50- 99.....	33	46	71	11	19	26	20	46	55
20- 49.....	30	41	51	9	11	17	40	70	89
Under 20....	36	41	49	11	13	19	36	47	69
Total...	147	257	354	46	83	110	120	243	300
Number of fields per owner.....		1.7	2.4		1.8	2.4		2.0	2.5

Fig. 33 --Scattered holdings in three Cache County dry-farming districts.

Wheat produced.--The wheat produced in the different regions varies both in amount and quality.

The wheat raised on most of the dry-farms is classed as hard red winter wheat of the Turkey red variety.¹ Since wheat of the highest grade is produced where conditions of growth are most difficult, the highest quality of wheat produced in Utah is found in Blue Creek and Hansel valleys, western Box Elder County. These two districts have established a reputation for a good quality of wheat, and this aids materially in its marketing. Levan Ridge grows wheat of a good quality, but it is generally mixed with rye, which lowers its milling value to some extent. Wheat from Cache Valley is usually mixed and therefore not the best milling wheat. Grain from Salt Lake and Utah Counties is of fair quality, but lower in milling value than that from the other regions named.

¹In 1924 Turkey red wheat occupied only 46.3 per cent of the total wheat acreage but at present Turkey red and Kanred, a related strain, are the two dominant winter wheats.

That from Millard and San Juan counties is usually a good milling grade.¹

County	Bushels per Acre ^a	Rainfall in Inches ^b	Mean Yearly Temperature ^b	Assessed Land Values per Acre
Cache.....	18.3	16.39	47.4	\$22.14
Box Elder.....	16.0	13.86 ^c	47.9	11.61
San Juan.....	14.0	17.38	47.4	5.07
Rich.....	13.8	10.33	....	7.84
Salt Lake.....	13.2	16.23 ^c	51.6	12.88
Juab.....	12.5	12.25	47.0	11.62
Tooele.....	10.0	13.72 ^c	49.9	5.63
Millard.....	9.1	15.10 ^d	47.4	7.30
Washington.....	7.0	8.81 ^d	58.9	7.19

Fig. 34.--Average yields, rainfall, temperature, and land values in nine dry-farm counties.

^aAverage yields obtained from data in the Fifteenth Census.

^bTemperature and rainfall averages for San Juan, Tooele, and Millard counties obtained by averaging records from two stations.

^cThese averages are probably higher than the rainfall found within the dry-farm regions.

^dRainfall in the dry-farm regions of Washington County may be a little heavier than indicated in the table.

Farm practices.--A few localities have farm practices peculiar to their parts of the state. Some of these peculiarities, such as outdoor storage and hail insurance, are closely related to natural factors. Others are a response to personal inclinations of the farmers or to commercial demands.

Storage.--The manner of caring for grain after it has been harvested varies somewhat throughout the state for several reasons, such as slight climatic differences, distance from loading points, and relative isolation of the region. In several dry-farm sections of northern Utah, but especially in Blue Creek and Hansel valleys, where there is no rainfall in the summer, farmers store their grain in the open with no protection.

¹Information from Grain Supervisor, Bureau of Agricultural Economics, United States Department of Agriculture, Ogden, Utah, October, 1935.

Hail insurance.--Across the extreme northern part of the state from east to west stretches a hail belt about fifteen miles wide. In Box Elder and Cache counties many farmers insure their wheat for a short period immediately preceding harvest because this region is subject to devastating hail storms.

Baling of straw.--Use of the wheat straw, which is plentiful and therefore cheap, varies with the locality and the price of hay. When the price of hay is low, the straw is often left on the fields and plowed under. The higher price of hay in the last few years has resulted in its replacement by straw on the market. West of Salt Lake City on the dry-lands, which are partly owned by men from a poultry-producing district, the straw is baled for their use.

The large farms of the dry-land regions of northern and central Utah produce wheat as a cash crop. It is true some small farms within these regions raise only enough wheat to furnish flour for the farmer and feed for his animals, but as a whole, these areas may be considered cash-crop regions. Even Washington County, although resembling San Juan County in the type of crops raised, produces cash crops almost entirely; in San Juan a large percentage of the farms produce many crops for their own use. Only the one region of southeastern Utah, then, may be considered a subsistence area. Thus the state contains two major types of regions, the commercial wheat areas in the northern and central parts of the state, and the San Juan subsistence area.

PART V

CONCLUSION

In general, the dry-farming industry is carried on today much as it has been in the past. Various changes in practices have taken place, however, and are now in operation. Some of these changes relate to the operation of land units, and the storage and shipping of wheat, and are as follows:

1. It is probable that land units throughout the state have not changed greatly in size, but there seems to be a tendency for fewer people to operate the land, thus confining the actual work to lessees and men who do custom work.

2. After the extravagant investment in machinery which

followed the period of big yields and high profits there has been an effort to use machinery co-operatively, and a tendency to return to horse-power.

3. Farmers wish to store their own wheat and sell when conditions demand or prices invite. They are even beginning to venture in wheat speculation. As in other parts of the country, more wheat is stored and shipped in bulk, which saves not only the cost of the bags but also the cost of sacking it. As a result of this movement the Blue Creek warehouse, which is owned by the Farmers National Grain Corporation, has been closed during the past two seasons.

4. Transport of wheat by motor has increased. Not only are the Juab County farmers hauling their grain to market, but also the farmers in other regions. From Hansel Valley and Blue Creek and even from southern Idaho, wheat is no longer hauled just to the loading points on the railroad at Kosmo and Lampo, but is taken to the grain market at Ogden.

5. County assessors in the various counties are becoming interested in learning what the assessed values of land are in other parts of the state, and the state itself is attempting to equalize these dry-land values.

Although large areas formerly used for dry-farming have been abandoned, much land is still being farmed with small profit. The United States Government is trying to remove from use these marginal and sub-marginal areas. At present the Administration has two projects in Utah involving the purchase of poor farm lands for conservation purposes. These projects include 30,000 acres in the Widtsoe Land Use Adjustment Project which is located in Garfield County, and 48,000 acres in the Central Utah Dry-Land Adjustment Project located in Juab and Tooele counties.¹ This land will be used for grazing purposes.

The dry-farming industry brought into profitable cultivation many thousand acres of land. The native vegetation of bunch and wheat grasses and sage was removed at the time the land was brought under cultivation. After being cleared for dry-farming, the native vegetation does not return for a long period of time and the land lies almost bare, subject to destructive erosion.

¹Letter from Chief of Project Planning and Control Section, Land Utilization Division, Resettlement Administration, Washington, D. C., November 30, 1935.

Thus, these areas not only are withdrawn from use for grazing purposes but through erosion become utterly useless and a menace to other lands. The government is now endeavoring to curb this soil erosion and supervise the use of the land so that its indigenous vegetation will return and these regions can again be used for grazing.

By 1933 dry-farming in Utah had been established somewhat firmly upon a scientific basis. Many limitations of the industry as well as its possibilities were recognized. The drought years had already caused a shrinkage in acreage and the Government later removed some farmers from sub-marginal lands. A study of this industry in Utah from its inception up to 1933 would seem to permit the following statements concerning its future, although Government policies and increase in scientific knowledge may make unexpected changes. The land utilized for dry-farming during the drought years (1931-1934) will probably continue to be so used. No great extension of acreage seems possible, although the building of a railroad into the San Juan area would increase the area farmed there. It is thought that direct connections with Los Angeles by an improved highway would greatly benefit this region. Series of wet years and high prices will coax farmers to return to low-yielding lands. The renewed use of such lands for dry-farming is discouraged and prohibited by present government policies as expressed in the Plans of the Resettlement Administration, Soil Conservation Act, Taylor Grazing Law and the proposed "Ever Normal Granary" plan. On the other hand, although dry-farm wheat yields are low, the high protein content of the wheat partially compensates for this, and the use of these lands for dry-farming meets a social as well as economic need in the development of Utah. Therefore it would seem that the acreage would probably not decline far below the 1933 level.

Within the industry, improved farming techniques will be utilized, especially by the areas least progressive at present. New types of drought resistant crops, perhaps some fodders, new strains of wheat, such as a smut-resistant variety for northern Utah, will increase production. It is probable that the tendency to consolidate holdings or lands operated will proceed more rapidly than division of property upon the death of owners. It is also probable that in this process of consolidation of farm units, cash-grain farming will progress at the expense of general farming.

Co-operative farming may again become an important factor.

Most changes in the industry may be expected from additions to scientific knowledge, the position of the United States in the World Export Trade, and shifts in government planning as related to agrarian policies and trade barriers.

Although the dry-farming industry has never realized the dreams of its founders, even at its period of greatest expansion during the years 1916 to 1922, nevertheless it has brought into wheat cultivation some 300,000 acres of land. In 1934 the land farmed by dry-farm methods constituted 15.3 per cent of the cropped land. Through its utilization in this manner the very low returns per unit area resulting from the use of the land for grazing have been increased to the higher returns derived from dry-farming.

With its frontier conditions and its farming methods in striking contrast to those of the East, the arid West still is, as Webb says,

the far country that lies at our door. It is a land of innovation and survival. It is different! Things go on there as they should in a far country --entirely unlike the way things go on in a near country It was (and still is) the place where the unexpected was (is) sure to happen, where the Eastern traditions and conventions would (will) not hold out and where Eastern practices could (can) no longer work.

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